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LEMON-CULTURE.

W. K. DALLAS, Citriculturist.

FOR many years lemon-trees (*Citrus limonia* Osbeck) have been grown in various parts of New Zealand, but only during the last twenty years has planting been carried out on a commercial scale. Lemons can be produced profitably in the Dominion, and already their culture has developed into a useful industry. The production of lemons on an economic scale is confined mainly to restricted areas at Keri Keri, Whangarei, Auckland, Tauranga, and Gisborne, Hastings, and Nelson. In recent years the acreage under lemons in these districts has increased considerably. There were 86,204 lemon-trees in registered orchards throughout the Dominion on the 1st October, 1934, distributed in the respective districts as follows :—

Whangarei	15,356	Motueka	921
Tauranga	21,541	Christchurch	45
Palmerston North	1,188	Hamilton	1,085
Nelson	2,287	Hastings	3,456
Blenheim	300	Wellington	145
Auckland	36,185	Mapua	704
Gisborne	2,945	Dunedin	7
Masterton	39		

These figures do not include the lemons-trees grown in gardens throughout the country for private use.

It is unlikely that New Zealand will be able to develop an export trade in lemons as the world's markets are already supplied by countries more favourably situated. The local market is capable of absorbing larger supplies of good-quality lemons than it does at present, but the trees already planted may be capable of supplying this trade when they come into full bearing. In the circumstances, the further planting of lemons on anything like an extensive scale is a matter that should be approached with caution.

VARIETIES.

The main varieties grown in the Dominion for commercial purposes are the Lisbon and the Eureka. Other varieties which are grown to a limited extent are the Villa Franca, Sweet Rind (a strain of Eureka), and Genoa.

Lisbon.—Fruit of good quality, medium in size, oblong, of good even shape, and firm with a thin, smooth, pale-yellow rind, and with comparatively few seeds. The tree is a good cropper and produces much of its fruit in the interior of the tree. It bears two crops a year, the winter crop being the main crop. It has large thorns, which cause injury to the fruits coming in contact with them and makes pruning and picking operations more difficult.

Eureka.—Fruit of good quality, medium to large in size, oblong, of good, even shape, and firm with fairly thick, wrinkled, pale-yellow rind, and with comparatively few seeds. The tree is a moderate and consistent cropper and is thornless. It comes into bearing earlier than Lisbon. Fruit is largely borne near the tips of the branches and on young trees is inclined to be coarse.

Villa Franca.—Fruit of good quality, medium in size, oblong, slightly pointed at blossom end, of good, even shape, and firm with a thin, pale-yellow rind, and nearly seedless. The fruit from the young trees is inclined to be rough. The tree is a heavy summer bearer, a vigorous grower, and is practically thornless. The branches have shorter joints than other varieties, and on this account this variety is suited to somewhat exposed situations. The tree is of a spreading and somewhat drooping habit.

Eureka (Sweet Rind).—Similar in appearance and quality to Eureka, but produces fewer seeds, yields a greater quantity of summer fruits, and produces a smoother type of fruit than Eureka. It comes into bearing early.

Genoa.—Fruit of good quality, medium in size, oblong, of good shape, smooth, and attractive in appearance. The tree is a heavy summer cropper and bears heavily while very young. It has a drooping style of growth, with fine laterals and foliage, and is thornless. It is not so vigorous as some varieties, but this probably can be overcome by an annual moderate thinning of the young fruits until the trees are six years from planting.

Stocks.

Since the commercial varieties of lemons grown on their own roots are susceptible to disease they usually are worked on to more resistant stocks.

It is very important that the stock should suit the conditions of the locality where the trees are to be planted. Many trees have died, while others have produced light and inferior crops, through the use of an unsuitable stock. The stock which is in most general use is the rough lemon known in Australia and New Zealand as "Citronelle," a horticultural variety of the lemon *Citrus limonia*. Other stocks which are in use to a limited extent are sweet orange (*Citrus sinensis*), sour orange (*Citrus aurantium*), trifoliate orange (*Poncirus trifoliata*), and the pomelo or grape fruit (*Citrus maxima*, var. *uvacarpa*).

The rough lemon, of which there are a number of strains, has been used extensively in a wide range of soils in all citrus-growing countries, but has the disadvantage of being sensitive to cold and susceptible to collar-rot, bark-blotch, gummosis, and citrus verrucosis in the heavier and wet soils. It is deep-rooting and has a well-developed root system,

which causes the trees worked on it, particularly those planted in light, sandy soils, to grow vigorously. In the early years of bearing the fruits produced are frequently poor in quality on account of the rapid growth of the trees, but after the advent of heavy bearing fruit of good quality is produced.

The sweet and sour orange stocks are more resistant to diseases than the rough-lemon stock. On the orange, the trees do not come into bearing as early as they do on the rough lemon, but remain productive for a longer period. Experience in other countries has demonstrated that the sweet-orange stock is suitable for light, deep, and well-drained soils and has a comparatively shallow-rooting system. It produces well-shaped trees. In this country stocks of this orange are usually raised from selected pips of the Cook Island sweet orange.

The sour, or Seville, stock is hardy and well supplied with deep-rooting roots and is adapted to most situations, but thrives particularly well on heavy soils.

The trifoliate orange is not recommended for commercial orchards, but may with advantage be used in domestic gardens where large trees are not desirable. It is a very hardy slow-growing stock with a dwarfing effect upon the scion. It forms a good deep-rooting system and is suited to localities with a rich heavy loam containing a fair amount of moisture. It is entirely unsuited to light, sandy soils.

Not a great deal is known of the performance of the Pomelo stock, but it is recorded that it is susceptible to collar-rot and gummosis in the heavier soils. It is also recorded that from a small and crooked tap-root a strong lateral root-system develops at a somewhat deeper level than the roots of the sweet orange.

Further experimental work remains to be done before definite recommendations can be made as to the stocks on which lemon varieties should be worked in this Dominion.

Raising Stocks and Trees.

The practice in raising seedlings for stocks is to save fruits from selected trees which exhibit a strong healthy growth. The seed is removed from the fruits, and the largest are selected and are stratified in sand until the time for planting arrives. The time best suited for planting the seeds is from the latter part of September to the end of October. The seeds are set out in well-prepared soil in rows 9 in. apart and 2 in. to 3 in. apart in the row. The seeds are set in drills 2 in. deep and covered to the depth of 1 in. Until the seedings are well established the soil is kept moist and well cultivated.

The seed-bed is protected from the winds and the hot sun by covering it with scrim or other suitable material. The soil is not allowed to become baked.

By the autumn, if the plants make reasonable growth, they reach a height of from 8 in. to 12 in. In the following spring the strong plants are set out in nursery rows 3 ft. apart and from 12 in. to 15 in. apart in the rows. The weaker plants may be allowed to remain another year in the seedling-beds, but it is better practice to destroy them. Diseased plants should be discarded. In the year following the transplanting, when the sap is flowing freely, which is usually from November to March, budding is done in the same manner as on other classes of

trees. The buds should, however, be inserted at a point 8 in. to 12 in. above the soil-level so as to lessen the possibility of the wood of the scion becoming contaminated with bark-blotch, &c.

Citrus stocks should not be budded until the wood has reached suitable dimensions, whether this be two or three years from the time the pip is sown. A lead-pencil is often referred to for illustrating the size of stock wood desirable, but a stock of this size cannot be relied upon to produce the growth required. A $\frac{1}{2}$ in. to $\frac{3}{4}$ in. orange stock and $\frac{1}{2}$ in. rough-lemon stock will be found to give more general satisfaction than those of smaller diameter.

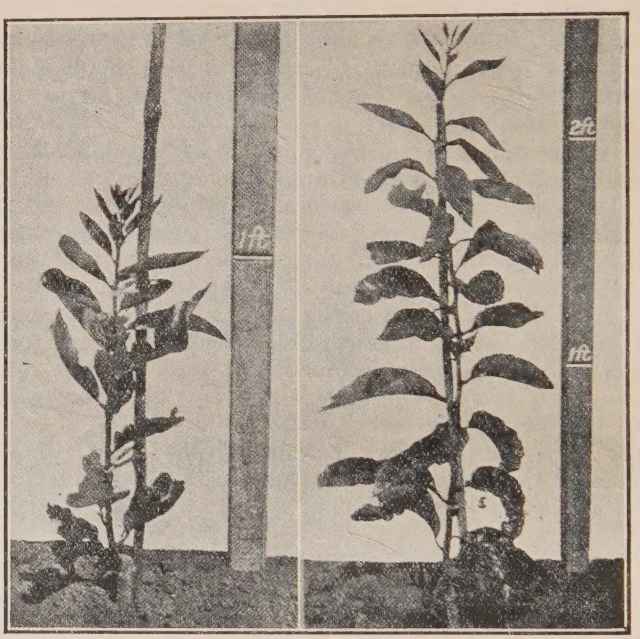

FIG. 1. THE EFFECT OF SIZE OF STOCK ON GROWTH OF THE SCION.

On left, Crisp's lemon on lime-stock of $\frac{1}{2}$ in. diameter, budded 15th March, 1920; growth made to 20th December about 15 in. On right, Crisp's lemon on lime-stock of $\frac{3}{4}$ in. diameter, budded on same date, but with about 30 in. of strong growth to 20th December.

The budwood should be selected from trees which are thrifty, heavy regular bearers, and producing fruit of approved type. On account of the bud-variations which occur on individual trees the fruit on the branches from which the budwood is taken should be carefully examined to ensure that it has the desired characteristics. The buds near the tip and near the base of the bud stick should not be used. The scions should be at least $\frac{1}{4}$ in. in diameter (about pencil thickness), rounded, and dark green in colour, with plump well-developed buds.

The months November and March, when the sap is flowing freely, are the best times to do the budding. When the buds are about to break in the following spring the stock should be cut back to within 8 in. above the bud. The wood left above the bud is used for tying the

young growth to, as this is better practice than tying it to stakes. In the following spring, after the danger from frost injury is over, the wood above the bud should be carefully removed with a sloping cut and a protective wound-covering applied.

The budded trees should remain in the nursery row for eighteen months to two years before being planted out in their permanent positions. Detailed information in reference to budding is given in Bulletin No. 81, "The Budding of Fruit-trees."

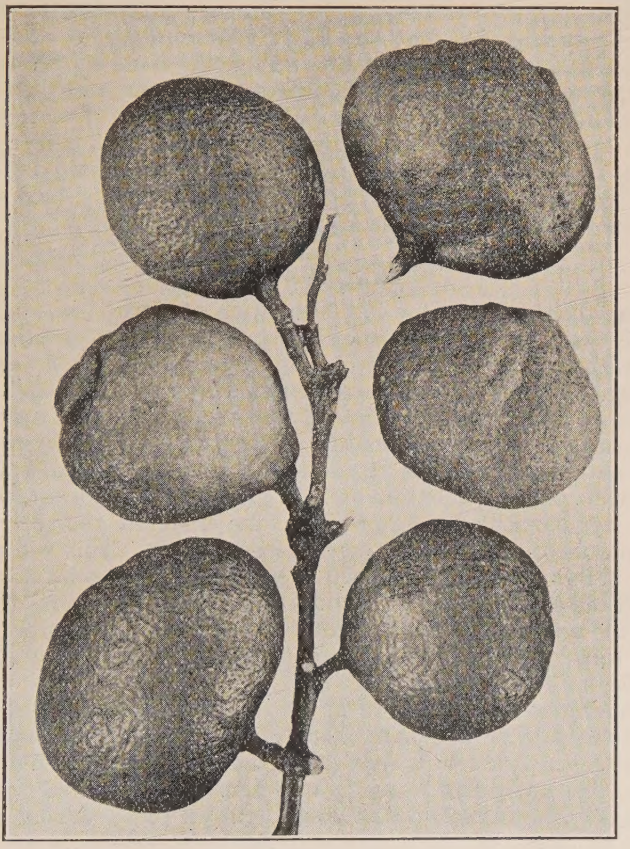

FIG. 2. OFF-TYPE EUREKA LEMON—TO BE AVOIDED WHEN SELECTING BUDWOOD.

Selecting the Young Trees.

In the establishment of a productive orchard success is largely dependent on the quality of the young trees.

Only thrifty well-rooted trees with well-coloured healthy bark should be selected. Weakly trees and those that have the lowest main branch less than 2 ft. from the ground-level should be rejected. Orders should be placed early with a reliable nurseryman, and no attempt made to obtain cheap lines. Maiden trees—one year from the bud—

should have one clean, straight stem from the point where budded. Two-year-old trees should have at least three strong thrifty branches. Trees that have been summer-pinched in the nursery to cause them to branch, and have made weak shoots, should be avoided.

Preliminary Treatment of the Trees.

Trees should be unpacked as soon as possible after their receipt from the nursery, and at once heeled-in. Heeling-in is done by opening up a shallow trench in which the trees are placed in a sloping position and at right angles to the line of the trench. Although the trees may be laid closely together they should be placed singly so that the soil comes in contact with all the roots. Then the roots should be covered with soil, which should be trodden moderately firm, and then more soil should be thrown on so as to leave a loose surface. The trees remain heeled-in until required for planting. Before heeling-in, all roots bruised in the process of lifting from the nursery should be cut back to above the injury, since any damaged roots left to die back are likely to seriously interfere with the formation of new roots.

Climate and Soil.

Among the essentials for the cultivation of citrus fruits are a comparatively warm climate, absence of extreme winter conditions, a fair rainfall without long periods of droughts, and good friable soil with a subsoil that will allow of deep rooting and perfect drainage. Lemons are grown on many types of soil, but that recommended is a deep sandy or clay loam over a porous subsoil. Since the trees are evergreen they are never dormant, so that the soil in winter should be well drained and warm to permit of continuous root-growth. On most stocks lemon-trees are not particularly deep-rooting, and therefore the subsoil should be of a nature that will encourage deeper rooting. This will assist the trees to better withstand drought conditions. The subsoil should be loose and either naturally well drained or capable of being thoroughly drained by artificial means. Shallow soils, heavy clay soils, swampy soils, or soils that have a hard-pan or an impervious clay subsoil are unsuitable for citrus-culture.

As lemon-trees are liable to injury by severe frosts areas in which they occur should be avoided. The best positions for orchards are the northerly slopes of low hills with easy grades or level land not locked in by hills. Areas exposed to winds or where fog lies heavily should not be selected. The rainfall in the citrus areas of the Dominion is usually sufficient to meet the needs of the trees.

Preparation of the Land.

No planting should be done until the whole area is properly prepared. It is a mistake to plant trees with the intention of making the necessary improvements afterwards, since in very few instances is it possible to do this thoroughly. Where there is scrub growing on the land it should be grubbed and burned. It is inadvisable to plough woody matter into the soil, as this material is liable to become a host for fungous diseases. If there is a sward of grass the first ploughing should be shallow—*e.g.*, skim-ploughing. The furrows should be broken down with disks and left for a few weeks. The land should be deeply cross-ploughed when the turf is dead, but if twitchy-grass plants are present

they should be grubbed and harrowed out before ploughing. The soil should be thoroughly worked and brought to a fine tilth. It is a good plan to devote two whole seasons to the preparation of the soil prior to planting. A crop of potatoes followed by lupins in the first season, followed by further working and cover crop in the following season, leaves the soil in suitable condition to receive the trees. Superphosphate 44–46 per cent. at the rate of 3 cwt. per acre, carbonate of lime 3 cwt. per acre, and sulphate of potash 1½ cwt. per acre should be sown with each cover-crop. The cultivation necessary for the potatoes breaks up the soil and suppresses weed-growth, while the lupins supply a good body of humus. Where practicable, the ploughing-in of the cover-crop should be delayed until fibre has developed in the plants, which would be at the commencement of the flowering-period.

Drainage.

Good drainage is essential to successful citrus-culture and must therefore be considered together with the preparation of the land. Such troubles as collar-rot, bark blotch, &c., are frequently caused by insufficient drainage. Most orchard areas require additional drainage. A drainage scheme should be capable of carrying away the water quickly when heavy rains are experienced. The necessary drains should be laid down before the cultivation of the land is undertaken. The soil must be free from surplus water in the winter as well as in the summer. The water-level should be as low as possible. Good drainage greatly assists in the improvement of the fertility of the soil. Land which cannot be readily drained should not be selected for citrus planting, and where trees are planted on soil which cannot be readily drained it may be advisable to put the land to some other use.

Shelter.

It is essential that the orchard should be adequately sheltered from all winds. Good, permanent shelter-belts around the boundary should be established at least two years before planting the orchard so that the lemon-trees may receive early protection. This shelter may consist of either *Cupressus lawsoniana* or *Cupressus macrocarpa*. *Pinus muricata*, *Pinus insignus*, and *Eucalyptus amygdalina* are also used by some orchardists.

Until the permanent shelter has reached a height to provide adequate protection it is advisable to subdivide the orchard into small blocks by planting out a quickly-growing temporary shelter such as *Albizzia lophantha*, which will give early results. This tree has proved very satisfactory, and from seed on suitable soils it makes rapid growth. The seed* should be sown ½ in. deep in the position where the trees are to grow. The use of such a shelter tree enables the lemon-trees to be planted out several years earlier than if planting had been delayed until protection was provided by the permanent shelter. This tree is, however, subject to borer, and therefore should not be allowed to

* The seed should be softened before sowing. Place the seed in a bucket and cover it with water that is nearly boiling; leave the seed in the water for ten or twelve hours; then pour the contents of the bucket into a fine-meshed riddle; mix the seed with a little dry sand to separate it. Sow as soon as possible; the seed must not be allowed to dry after soaking.

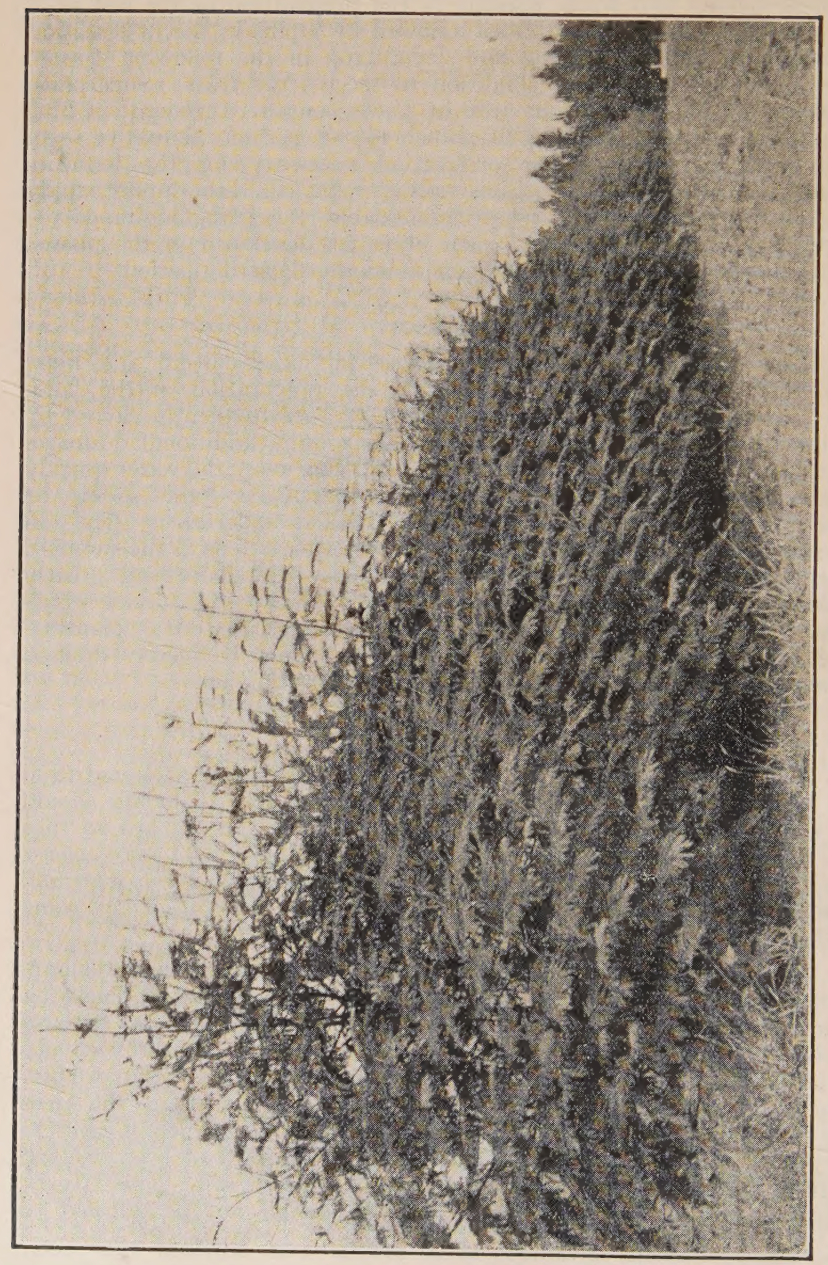

FIG. 3. ALBIZZIA LOPHANTHA EIGHTEEN MONTHS FROM SOWING OF SEED (AT KERI KERI).

remain after the permanent shelter has reached sufficient height to give protection to the orchard. Experience has shown that citrus trees respond to good shelter. Since young trees checked in growth by exposure for several seasons seldom make satisfactory growth afterwards it is far better to delay planting for a year or two rather than set out trees in exposed positions.

Before planting the shelter trees the land should be well worked and a good tilth maintained until the trees become so large as to make satisfactory cultivation impracticable.

(To be continued.)

SWEDE AND TURNIP VARIETIES.

THEIR DESCRIPTION AND DISTRIBUTION IN NEW ZEALAND.

J. W. HADFIELD and R. A. CALDER, Agronomy Section, Plant Research Station, Palmerston North.

(Continued.)

CRIMSON KING GROUP.

Varieties: Crimson King (Fig. 4*a*), Elephant (Fig. 4*b*), Monarch (Fig. 4*c*), Abundance (Fig. 4*d*).

Foliage medium green with bluish tinge, mid-rib and stalk reddish-purple. Skin colour a deep and somewhat glossy purple. Shape, tankard, with parallel sides. Flesh yellow.

Of the twenty-four samples sent in for trial two were wrongly named and five were somewhat mixed in type.

In all trials Crimson King (Fig. 4*a*), Elephant (Fig. 4*b*), and Monarch (Fig. 4*c*) appeared to be identical, and this fact was recorded as far back as 1918 by Mr. J. W. Deem, late Director of the Fields Division, who, when reporting on trials, described them as strains of the same variety. Most of the seed is sold under the name of either Crimson King or Elephant. The variety is regarded as early, stands well out of the ground, and gives satisfactory yields over a wide range of conditions. It is most extensively grown in Southland under the name Elephant, but in the North Island is better known as Crimson King. Very little is known of Abundance (Fig. 4*d*).

CHAMPION GROUP.

Varieties: Champion (Fig. 5*c*), John Bull, Skirving's Purple Top, Carter's Masterpiece.

Foliage has a bluish tinge and the mid-rib and stalks reddish-purple. Skin is smooth, colour a deep purple. Globe-shaped, almost spherical. Flesh yellow.

A few lines of John Bull were included in this group. Champion and Skirving's are grown to a limited extent only, and John Bull is of still less importance. Carter's Masterpiece has been placed tentatively in this group as a result of one year's trial.

BRONZE TOP GROUP.

Varieties : Hernings (Fig. 5*b*), Invicta, Halewood, Hurst's Bronze Top, Incomparable, Caledonian, Great Crop, Up-to-Date.

Foliage light to medium green, with sometimes a yellow and sometimes a blue tinge. Mid-rib and stalk light green, sometimes tinged

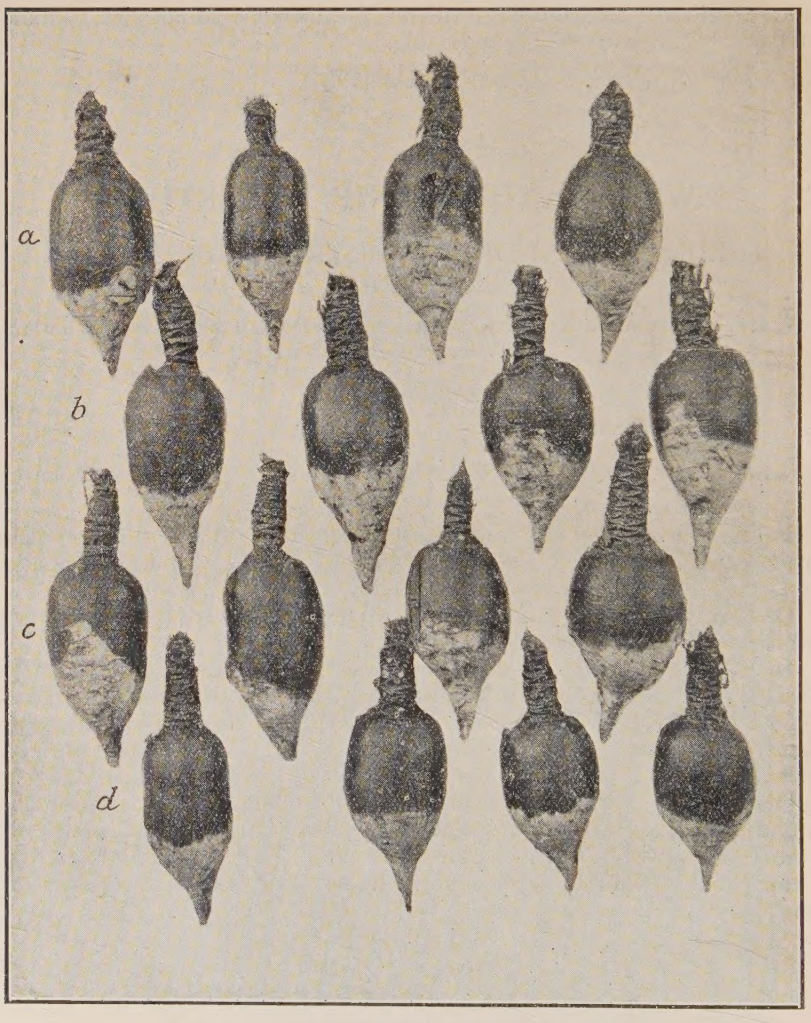

FIG. 4.

a Crimson King ; *b* Elephant ; *c* Monarch ; *d* Abundance.
No distinction could be found between these varieties.

with yellow. In Hernings stalks are occasionally tinged with reddish-purple. Shape generally oval, although Hernings and Up-to-Date are globe-shaped. Shoulders sloping or rounded. Colour a mixture of purple and green or bronze, Hernings varying from pure green to a dull purple, the dominant shade being a purple-bronze. Flesh yellow.

Bronze Tops are not extensively grown in New Zealand and represent but 5 per cent. of the total area. Hernings, which is the most important (Fig. 5*b*), was first introduced in 1927 as Bangholm Improved Purple Top, Hernings strain, and tested out at various places. In more extensive trials conducted at the Gore Experimental Farm in 1928–29 and 1929–30 it proved to be exceedingly resistant to club-root, the yields appeared satisfactory, and the roots palatable. Its extension has been limited, however, owing to the fact that in a medium crop the roots are too deeply buried and the yields have proved irregular and often well below such varieties as those in the Superlative and Majestic group. Perhaps a still more serious check to its extension has been due to the importation of lines which proved on trial not to possess as satisfactory resistance to club-root as did the original importations. Finally, Hernings frequently has been reported to be more highly infected with dry-rot than other varieties, possibly due to susceptibility, but more probably to the seed being highly infected.

The several varieties placed in this group are by no means all similar. Up-to-Date is becoming increasingly popular, but of the others only odd crops are grown, and there is at present a tendency for Hernings to decline in popularity.

GREEN TOP GROUP.

Varieties: Sutton's Green Top, Benefactor, Wilhelmsburger Otofte, Hurst's Conqueror.

Foliage, mid-rib, and stalk of a medium green with yellow tinge. Globe-shaped, with rounded shoulders. Skin green. Flesh yellow.

Green Top varieties of swedes are even less popular in New Zealand than the Bronze Top, and, with the possible exception of Wilhelmsburger Otofte, only in certain localities do they appear to give satisfaction.

Benefactor (Johnston's) is apparently identical with Wilhelmsburger Otofte. The variety has exhibited marked resistance to club-root and is more consistent in this respect than Hernings. The first trials were reported from the Gore Experimental Farm in 1930–31, when it out-yielded Hernings and proved to be more highly resistant to club-root. At this Station during the past season it has given a yield equal to Majestic and considerably in excess of Hernings. Officers of the Mycological Section of the Plant Research Station regard this variety as most promising, and are controlling the production of seed, free from dry-rot infection, from a strain of proved resistance to club-root.

WHITE FLESHED - PURPLE TOP GROUP.

Varieties: Vilmorin White Fleshed Purple Top (Fig. 5*a*), Sutton's Sensation.

Foliage dark purplish-green, mid-rib and stalk distinct purple. Shape, long tapering tankard, with deep tap-root often associated with pronounced fang-development. Skin colour a very deep purple. Flesh white and firm.

The two varieties of this group may be regarded as the same, but Sutton's Sensation is a superior selection in which fang-development has been reduced to a minimum.

The variety was originally introduced by Mr. J. W. Deem, late Director of the Fields Division, in 1919, and was tested out at the Stratford Demonstration Farm, where it proved to be less infected

with dry-rot than any other variety. In nine subsequent trials of which records are available it is stated to have been less infected with dry-rot, although recent observations by the Mycological Section do not support the suggestion that the variety is resistant. In nearly all trials it has given the highest yield. Thus in a series of ten trials in Canterbury in 1926–27 and 1927–28 it outyielded the control on every farm, giving an average increase of 6·1 tons per acre, and in the case of large roots showed a significant increase in dry matter of 11 per cent. over control. It may be said of this variety that it is hardier and gives heavier yields than any other and yet occupies only

FIG. 5.
a White Fleshed Purple Top ; *b* Hernings ; *c* Champion.

1 per cent. of the area sown to swedes. It has the disadvantage of being deep rooted and fangy, resulting in a certain proportion of loss when feeding. Despite this loss, however, it would probably still outyield other varieties. Furthermore, its popularity suffered a severe check when, at a critical period, a large consignment of seed incorrectly named was imported and widely distributed.

Distribution of Varieties.

The following table contains, as near as can be obtained, information regarding the popularity and distribution of swede varieties in New Zealand.

TABLE 2.- THE DISTRIBUTION OF SWEDE VARIETIES IN NEW ZEALAND, STATED AS THE ACREAGE IN EACH DISTRICT AND AS A PERCENTAGE OF THE AREA IN SWEDES IN EACH DISTRICT, WITH A SUMMARY FOR ALL NEW ZEALAND.

Area devoted to		Southland, Mid and South Otago.	Central and North Otago, South Canterbury.	Mid and North Canterbury.	Marlborough and Nelson.	Manawatu and Wanganui.	South and North Taranaki.	Wairarapa, Hawke's Bay, and Poverty Bay.	Waikato, King-country and Central Plateau.	North and South Auckland, Bay of Plenty.	All New Zealand.
All varieties		73,800	27,100	7,450	900	24,100	10,950	6,300	37,600	6,650	194,850
Crimson King ..	Percentage	*	4·7	2·7	3·0	18·1	5·4	2·6	19·2	12·9	7·8
	Acreage	..	1,269	197	27	4,380	576	165	7,232	862	15,281
Elephant	Percentage	26·0	6·0	2·7	..	..	..	..	..	2·6	11·0
	Acreage ..	19,100	1,624	197	..	..	..	..	..	176	21,410
Monarch	Percentage	*	..	*	..	..	*	..	*	8·6	1·2
	Acreage ..	..	..	..	..	..	..	..	..	574	2,249
Majestic	Percentage	2·0	10·9	..	3·3	..	..	3·6	4·4	*	3·9
	Acreage ..	1,550	2,940	..	30	..	..	231	1,760	..	7,509
Grandmaster ..	Percentage	7·6	13·0	*	..	*	14·1	2·1	4·4	*	6·9
	Acreage ..	5,620	3,560	..	..	..	1,542	132	1,760	..	13,536
Tipperary ..	Percentage	2·0	*	*	..	*	*	..	..	..	1·1
	Acreage ..	1,550	..	..	..	..	..	..	..	..	2,077
Superlative (Garton's)	Percentage	18·3	20·9	47·6	36·7	30·4	8·8	40·2	20·9	27·3	22·3
	Acreage ..	13,540	5,674	3,550	330	7,230	966	2,535	7,856	1,820	43,451
Masterpiece (Webb's)	Percentage	19·0	8·3	12·4	*	10·0	9·1	9·7	14·2	3·9	13·9
	Acreage ..	14,160	2,246	920	..	2,410	994	615	5,472	262	27,143
Success	Percentage	2·0	*	2·7	..	*	*	3·1	..	*	1·3
	Acreage ..	1,550	..	198	..	..	..	198	..	..	2,440
Magnum Bonum ..	Percentage	*	*	*	*	*	5·8	5·9	1·8	*	1·9
	Acreage ..	..	..	..	..	..	648	372	704	..	3,652
John Bull ..	Percentage	*	..	*	..	..	*	..	..	6·8	0·6
	Acreage ..	..	..	..	..	..	..	..	..	405	1,144
Superlative (Sutton's)	Percentage	6·8	18·6	14·9	22·0	20·0	36·4	20·5	18·7	24·8	14·9
	Acreage ..	4,990	5,054	1,095	198	4,820	3,990	1,296	6,048	1,651	29,082
Champion ..	Percentage	*	*	*	16·6	..	*	*	*	*	1·0
	Acreage ..	..	..	..	150	..	..	..	..	..	1,931
Masterpiece (Carter's)	Percentage	*	3·2	*	..	*	5·1	..	..	..	1·8
	Acreage ..	..	980	..	..	..	562	..	..	..	3,447
Hernings	Percentage	3·7	2·8	5·3	6·6	10·8	*	5·4	*	2·8	4·3
	Acreage ..	2,700	735	395	60	2,630	..	345	..	186	8,322
Up-to-Date ..	Percentage	..	*	..	..	..	*	..	*	*	0·5
	Acreage ..	..	..	..	..	..	..	..	..	..	924
Green Top (Sutton's)	Percentage	*	2·8	*	*	..	..	*	..	..	1·5
	Acreage ..	..	735	..	..	..	..	..	..	..	2,865
White Fleshed Purple Top	Percentage	..	2·9	*	2·6	*	3·5	3·5	..	..	1·0
	Acreage ..	..	779	..	24	..	360	222	..	..	1,860

* Varieties so marked represent under 2 per cent. of the area of the district, allowance for which is made in the totals.

Yellow-fleshed Turnips.

Varieties may be grouped most conveniently as follows:—

Purple Top: Purple Top Yellow Aberdeen, Waite's Eclipse, Bruce, Favourite.

Green Top: Green Top Yellow Aberdeen, Fosterton Hybrid, Dale's Hybrid, Wallace, Golden Vale, Early Sheepfold, Perfection.

Green Top Netted: Romney Marsh, Centenary.

Yellow Top: Yellow Tankard.

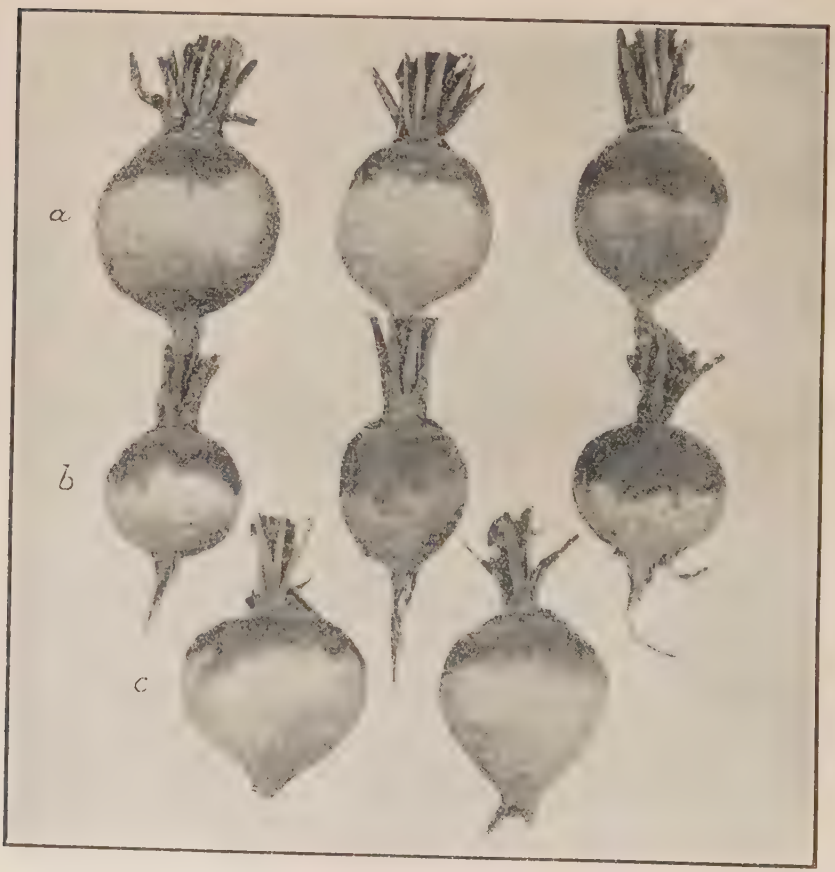

FIG. 6.

a Purple Top Yellow Aberdeen; *b* Waite's Eclipse; *c* Favourite.

Yellow-fleshed turnips occupy only about 73,500 acres, or 17 per cent., of the total area devoted to swedes and turnips, and more than half of this acreage is in Southland and South Otago. The crop is somewhat exacting in its requirements, requiring a cool climate, and is quite unsuited to a large part of New Zealand. It would appear that the growing of yellow fleshed turnips is steadily declining in all but the most favoured districts.

YELLOW FLESHED - PURPLE TOP GROUP.

Varieties: Purple Top Yellow Aberdeen (Fig. 6*a*), Waite's Eclipse (Fig. 6*b*), Bruce, Favourite (Fig. 6*c*).

Foliage green mottled with purple, stalk and mid-rib purplish, crown and shoulders rounded. Shape, globe. Favourite is rather more tapering. The colour is dark purple and is due to an association of red with green. The green can generally be seen as an uneven and variable band at ground-level or, if not apparent here, can be discerned

FIG. 7.

a Green Top Yellow Aberdeen; *b* Fosterton Hybrid; *c* Dale's Hybrid.

in the underlying tissue if a thin layer of outer skin be scraped away. The colour below ground-level varies from a creamy-yellow to red in all varieties except Favourite, where it tends to be a bright orange. Skin smooth. Flesh yellow, slightly mottled with white. This group occupies over one-half of the area devoted to yellow-fleshed turnips.

Purple Top Aberdeen is generally considered earlier than Green Top Aberdeen. Under favourable conditions the yield and keeping-qualities are excellent. Purple Top Aberdeen, representing as it does about 35 per cent. of the area devoted to yellow-fleshed turnips, is by far

the most popular variety. Bruce is very definitely resistant to club-root. This variety and Wallace (Green Top) have been in cultivation in the North of Scotland for nearly a century, and were brought to notice by Mr. W. M. Findlay, of Aberdeen, and the North of Scotland Agricultural College. It was introduced to New Zealand by Mr. R. B. Tennent, Director of the Fields Division, in 1931, and first tested at Gore in 1931–32. Since then extensive trials have been carried out and numerous farmers have grown the variety with gratifying results and already it represents 5 per cent. of the yellow-fleshed turnips grown. Bruce, as originally imported, was a mixture of Purple Tops and Green Tops. The Purple Top variety now goes under the name "Bruce," and the Green Top under the name "Wallace." As far as is known, Bruce is equal in yielding-capacity to Purple Top Yellow Aberdeen, and, in addition, is resistant to club-root, which, in those parts where yellow-fleshed turnips are grown, is frequently the most important consideration. Some lines of Bruce imported into this country have proved susceptible to club-root, and either the strain has not been resistant or the seed has been mixed with or replaced by Purple Top Yellow Aberdeen, to which it is so similar as to defy differentiation. Several growers in Southland are now producing Bruce and Wallace seed under Government certification, which will be a distinct safeguard in this direction. It is almost certain that in future Bruce will be grown extensively on land in which club-root occurs.

YELLOW FLESHED-GREEN TOP GROUP.

Varieties: Green Top Yellow Aberdeen (Fig. 7*a*), Wallace, Fosterton Hybrid (Fig. 7*b*), Dale's Hybrid (Fig. 7*c*), Early Sheepfold, Perfection, Golden Vale.

Foliage, green-tinged or slightly mottled with purple. Mid-rib and stalks green, but occasionally coloured with purple at base. Crown rounded; Fosterton Hybrid rather flatter than others. Shoulder rounded; Fosterton Hybrid a little squarer than others. Roots globe-shaped; Green Top Yellow Aberdeen, Wallace, Fosterton Hybrid, and Dale's Hybrid probably more tapering than others. Skin colour above ground-level green; below, colour varies—in Early Sheepfold, Perfection, and Golden Vale colour is a rich orange, in Green Top Aberdeen and Wallace a deep yellow, and in Fosterton Hybrid and Dale's Hybrid a pale yellow. Skin-texture smooth. Flesh yellow to light orange in colour, and moderately firm.

This group is not grown as extensively as the Purple Tops. Of the varieties listed above, Green Top Yellow Aberdeen dominates the rest, representing over 27 per cent. of the New Zealand acreage, and second only to Purple Top Yellow Aberdeen, followed by Fosterton Hybrid and Dale's Hybrid. The three are extremely difficult to distinguish one from the other.

Wallace is as yet only occasionally grown. The comments made regarding Bruce in the Purple Top Group apply also to Wallace, the two varieties being of the same origin. The variety may therefore gradually replace Green Top Yellow Aberdeen in all districts where club-root is prevalent. As Wallace can scarcely be distinguished from Green Top Yellow Aberdeen except in regard to its resistance to club-root, every precaution must be taken to safeguard the purchaser, and the production of Wallace seed in New Zealand under certification is likely to prove of considerable benefit in this respect.

(To be continued.)

SOME CAUSES OF REJECTION OF PIG-CARCASSES.*

J. E. McIlwaine, Veterinary Officer, Department of Agriculture, Palmerston North.

One of the first considerations in the setting of a standard in meat exports is the freedom of those exports from any suspicion of disease, contamination, or taint. It is essential that stock sent to the works for slaughter be healthy and normal in every way, be representative specimens of their breed, and carry sufficient condition to comply with the requirements of the buyer, the grader, and the meat inspector, and, lastly and probably of most importance, the stock should fulfil the requirements of the housewife and the consumer in the buyer's country. Even with provision of all the care necessary in respect to these matters occasional cases crop up where carcasses or parts of carcasses are condemned on account of bruising and accidents. Bruising is less liable to occur in the case of the pig. Occasional cases of broken legs are seen, and such accidents cannot be provided for. There are, however, obvious cases of skin-disease, spoken of as necrotic or spirochætal ulcers, cases of diseased feet and deformities of one kind and another, cases of enlarged joints, and abscesses at the site of castration. These cases occur from time to time, and the farmer who provides such cases is aware of the treatment they receive when they arrive before the meat-inspection staff. Any animal with an obvious lesion is rejected at once for export; the inspector considers the case on its merits in regard to the salvage of portion of the carcass for local consumption. The entire carcasses from healthy animals are what the buyer pays for and what he expects. The meat-inspection carried out at this end is essential to prevent the condemnation of diseased carcasses arriving at the consumer's end. Farmers dissatisfied with the results obtained in regard to stock sent forward should visit the works to see the many causes for rejection.

Tuberculosis.

One of the main diseases to which particular attention requires to be paid in pig-inspection is tuberculosis. The pig is particularly susceptible to tuberculosis, and once the disease has become established the pig is more susceptible to generalization of the disease than any of the other domestic animals. Tuberculosis in the pig may be contracted from the milk-supply, when it is said to be of bovine origin, or it may be contracted from fowls, when it is said to be of avian origin. In the second case the disease in pigs could be reduced substantially by not allowing the pigs and fowls to associate, and, above all, by not feeding pigs on fowls which die from obscure causes. In a case which recently came under notice a fowl was grossly affected with tuberculosis, and the farmer admitted that he was in the habit of throwing any fowls which died to the pigs for consumption. Under the regulations the feeding of raw offal from slaughterhouses to pigs is illegal, and the reason for this becomes clear from the experience cited.

Tuberculosis may affect any part of the carcass of the pig. It may, and does, affect the lungs and the pleura (hence the name pleurisy)

* Portion of an address to the Manawatu Pig-recording and Development Club.

quite commonly, so that great care is necessary in regard to the inspection of the pleura in pig-carcasses. If pigs are affected with pleurisy of a non-tubercular origin to such an extent that the pleura is damaged and requires to be stripped, the mutilated carcass is viewed with grave suspicion at the consumer's end. The first thought that will arise in the inspector's mind is that the pleura was stripped with a view to removing pleuritic lesions which may have been due to tuberculosis or to other causes. It is therefore most important that pleurisy in pigs, due to any cause whatever, be prevented by all means in the farmers' powers.

Tuberculosis in pigs is commonly seen affecting the glands of the head. If it is confined to the head only the head is condemned, and the remainder of the carcass may be passed for export. A concession was obtained in regard to such carcasses within recent years as a result of representations made by the authorities at this end. Previously only carcasses entirely free from disease, having the head intact, were allowed to be exported.

Tuberculosis may be found in the abdominal cavity, in the glands attached to the bowels, and to the liver or in the liver itself, or it may be found on the membrane covering these organs and lining the abdominal cavity. Tuberculosis may be found in any of the groups of lymphatic glands in the carcass, and, lastly, it may be found affecting the bones of the spinal column. Because of the many parts of the body subject to tuberculosis, adequate inspection of pigs is necessary at this end. A certificate is attached to each carcass which is passed for export. The certificate reads as follows: "This meat has been examined by me, and by ante- and post-mortem veterinary inspection is found to be free from disease and suitable in every way for human consumption, and the meat has not been treated with chemical preservatives or other foreign substances injurious to health." The certificate carries the signature of the veterinary officer responsible for such inspection. The inspector occupies a very responsible position, and each carcass must be judged on its merits. The inspector's position is not to condemn more than is necessary, rather is he in the position of trying to salvage as much as possible and still keep within the standard required.

Septic Conditions.

Other causes of condemnation of pig carcasses for export include, in a general sense, all septic conditions affecting the skin, joints, or flesh of the carcass. In connection with the skin, pigs have been forwarded for slaughter affected with septic barbed-wire cuts, abscesses in the scrotal region as a result of faulty castration, septic feet and enlarged joints, and large necrotic ulcers on the skin. All of these conditions can be prevented and treated by the farmer on the farm. Cuts and wounds in the pig heal with difficulty, but care and attention in keeping the wounds dressed with some antiseptic preparation prevent them from becoming septic and also prevent the development of the black necrotic ulcers. Tar is recommended as a dressing which adheres and allows healing to take place. The prevention of abscesses in the scrotal region is most important. Quite frequently abscesses are found in this region when nothing is apparent on the skin; these are described as "cold" abscesses. At the same time a small opening may be seen on the skin which leads to a big abscess situated more

deeply. These abscesses are definitely the result of careless and faulty castration of the young boars. Because of the situation of these abscesses any unnecessary excision in regard to their removal injures the hams, the most valuable cuts in the carcass. It is clear, then, that the castration of young pigs is an important operation on the pig-farm and calls for care and attention. No difficulty should be experienced provided the pigs are castrated at an early age, about three or four weeks of age. A wound in a young pig heals much more quickly than a wound in an older pig. The site of operation should be washed thoroughly. A clean knife should be used for making the incision, and the pigs should then be placed in a pen containing clean straw bedding or in a clean paddock with a fresh sward of green growth. A bold incision should be made in the skin to release the testicle; a small cut is liable to prevent complete drainage from the wound afterwards, and if a pocket forms an abscess is liable to be the result. A suitable wound does not require any special treatment afterwards, the main essential being to keep the pigs in a clean place until healing commences. Some owners use strong disinfectants after castration, but the unfortunate sequel to the application of these is that the pig drags his hindquarters along the ground with a view to removing the irritant. The result is the immediate and direct contamination of the wounds instead of the prevention of contamination. There is no excuse for the farmer who leaves his pigs until they become older, and, as sometimes happens, castrates them a few weeks before he disposes of them as porkers. Inspectors condemn pigs for boar taint or sexual odour. Such condemnations should arise only in cases of rig pigs or "stags" where the farmer is unable to castrate them. The seriousness of faulty castration and abscess-formation lies in the fact that secondary abscesses are liable to be found in deeply situated glands and the sepsis may even extend to the abdomen and set up a chronic form of peritonitis, to which reference is made later.

Any septic condition of the foot of the pig should be attended to by cleansing the foot, removing any foreign body (such as glass or wire), opening up any abscess and allowing drainage, and dressing the foot with tar and tow.

The large, ugly necrotic ulcers on the skin of pigs are amenable to treatment. These skin-lesions often are seen on pigs on farms where the drainage is bad, where the feeding-conditions are unsatisfactory, and where contamination is apt to occur as a result of the general dirty and insanitary conditions. With improved sanitation and improved methods of swine husbandry generally the formation of ulcers of this nature can be prevented. If, however, they arise, they are amenable to treatment. The treatment consists of scrubbing the sores with a brush and soap and water to remove the thick crusts. The dusting of the surface with tartar emetic (potassium antimony tartrate) has been shown to be effective in healing the sores. Many other agents have been tried and have failed to bring about recovery. These are not cases of cancer, as they have been described by some farmers. They are, however, liable to increase in size, to penetrate deeply into the flesh, even to infecting the bone, the result being unsightly and unwholesome-looking sores which render a carcass unfit for human consumption. If this skin-disease of pigs occurs on a farm and it is not possible to improve the sanitation of the pig section,

then it is necessary to move the pigs to a new area. The contaminated area should be limed and ploughed and sown down in crop. In due course the pigs may be moved back again to this area without any fear, provided reasonable sanitary precautions are then taken.

Pleurisy.

Pleurisy is inflammation of the pleura. The pleura is the very thin membrane which lines the chest cavity and covers the surface of the lungs. This same membrane is reflected and covers the heart, where it is known as the pericardial sac, taking its name from the organ which it surrounds. Thus if one speaks of pericarditis or pleurisy one is referring to inflammation of practically the same membrane in the chest cavity. Pleurisy may extend to pericarditis or pericarditis may extend to pleurisy, and frequently the two are present in the same animal.

A simple means of classification of the types of pleurisy met with in the pig may be as follows: (1) Specific types of pleurisy due to specific diseases, such as tuberculosis, pasteurellosis, or pleurisy due to parasitic invasion; (2) simple or non-specific pleurisy, which may or may not be associated with pus-formation. If pus is present in any case, the condition is described as septic pleurisy.

Tuberculous pleurisy in pigs is due to ingestion of the tubercle bacillus either in contaminated food or water. The most common source of tuberculous infection in pigs in New Zealand is the milk-supply. Skim-milk and whey form such an essential part of the diet of pigs that if the milk by-products are contaminated the pigs are likely to contract the disease from this source. Pigs may contract the disease from depasturing on paddocks which have been fouled by tubercular cattle or by tubercular fowls. Uncooked offal containing infection may be fed to pigs. Pigs may also contract the disease from one of their fellows as a result of contact. This is not common.

Prevention of infection of the food-supply, from any of the sources mentioned, is the sheet anchor in reducing and eliminating this disease from your pigs. If there is any reason to suspect the milk-supply as the source of the trouble, then the dairy herd should be examined and the cow or cows giving tubercular milk must be removed from the herds. The alternative is the boiling of all milk products before feeding them to pigs. The short life of the pig is a factor in preventing the disease from becoming as advanced as it sometimes does in the case of dairy cattle. The risk of infection of the pigs from grazing on paddocks which have been contaminated by cattle does not appear to be a serious one. The benefits obtained from such grazing under New Zealand conditions of sunshine will outweigh any risks taken. Still, there is no reason why such grazing cannot be controlled, and the risk is then removed. In a similar way the risk of infection from poultry can be controlled. Pleurisy due to chronic cases of swine-fever needs no consideration, as this disease does not exist in New Zealand at the present time. The disease of pigs known as pasteurellosis exists on a large number of pig-farms in New Zealand. The disease is an infectious type of pleuro-pneumonia which seriously affects young pigs when an outbreak occurs. Young pigs in many cases succumb to the disease, whereas there is every reason to believe that older pigs may develop chronic

lesions and survive until they reach the butcher. Affected pigs are unthrifty in appearance, have a distinct cough when disturbed, and take a longer time to fatten. Pasteurellosis is liable to break out on a farm where large numbers of pigs are kept in a crowded area and where the hygiene and sanitation of the pig-quarters leaves much to be desired. It is only natural that a lowered resistance to the disease is also brought about by inadequate and improper feeding and housing. The mortality in young pigs in New Zealand from this disease alone is alarming. There is no doubt whatever that if greater attention is paid to the cardinal matters—improved housing and feeding, and improved sanitation—the alarming mortality in young pigs would be reduced to reasonable proportions. This applies to all pigs being reared and kept on farms during the winter and spring months, when the housing, drainage, and feeding on many farms is quite inadequate to prevent the onset of disease. Better, warmer, and more hygienic types of houses are being provided, but much improvement is still needed in this respect. The old type of sty raised on stilts, exposed to cold winds in front, and subject to draughts from below, with a cesspool underneath, is most undesirable. Warmth and shelter from prevailing winds and rain are absolutely essential for all pigs, but more so in the case of young litters during the colder months. The provision of comfortable quarters reduces the feed-bill, as the animal-heat is maintained from the food-supply if it is not otherwise provided for. More use could be made of straw bedding as a protection for young pigs during the colder months. By all means utilize the grazing-system as much as possible, but if the young pigs are not occupied in grazing or feeding, then I advise that they be closed up in warm comfortable quarters where they are protected from the climatic conditions with much less risk of disease in its various forms.

Pleurisy may be due to parasitic invasion. Young pigs are subject to worms of various types. The young pigs may ingest the eggs of the parasites from the udder of the sow soon after farrowing. The eggs are swallowed and the larvæ hatch out and the particular type of worm, which is known as the lung-worm of the pig, finds its way to the bronchial tubes and lung tissue. If numerous, these worms set up localized areas of pneumonia in the lungs which may spread to pleurisy in certain cases. In addition, it has been shown that the larval stage of the worm, which normally inhabits the intestine of the pig, is passed in the lungs of young pigs and is responsible for the condition known as "thumps" or "blows." If pneumonia is set up as a result of parasites, pleurisy is also liable to be present, and the adhesions of pleurisy are liable to be present when the pigs are killed.

Suitable measures in regard to the prevention of all worms in pigs consists of improved drainage and sanitation and the rotational movement of pigs from paddock to paddock, infested paddocks being used for cropping.

Clean farrowing-pens should be provided. The drainage of the section must be carried out well to prevent the formation of surface wallows, which are notorious beds of infection for worms and for other diseases. In surface wallows the eggs of the worms are washed into the wallows by the surface water. If a wallow is necessary for pigs in the warmer weather, let it be a concrete wallow which can be thoroughly cleansed from time to time. The concrete wallow may

also be used as a means of washing a sow's udder before farrowing, and if a layer of oil covers the water in the wallow the dressing of oil prevents lice and mange.

Probably the greatest number of cases of pleurisy in pigs is of the non-specific type. The main causes of pleurisy of this type are lack of adequate housing and lack of adequate feeding of the young pigs after weaning. There is no doubt that the greater number of such cases occurs in pigs being carried through the winter and spring months. Any factor which lowers the natural resistance and natural defensive or protective powers of the body renders the subject a prey to disease, particularly to pleurisy, and inadequate feeding lowers the resistance of all animals, and especially that of young animals. From observations on farms there is no doubt that more attention might be paid to giving more complete diets than those at present in use, and that better-balanced diets might well be provided for young, growing pigs.

In a word, the basis of the prevention of pleurisy in pigs is the provision of warmer houses during the winter months, and of comfortable and hygienic conditions and the feeding of diets which are plentiful and well balanced.

APHIDES AFFECTING CULTIVATED PLANTS.

(6) THE BLACK CITRUS APHID AND SOME OTHER TREE APHIDES.

W. Cottier, Entomology Section, Plant Research Station, Palmerston North.

The aphides dealt with in this paper are (*a*) the black citrus aphid, *Aphis citricidus*, (*b*) the poplar-leaf petiole gall aphid, *Pemphigus populi-transversus*, (*c*) the elm-leaf gall aphid, *Eriosoma lanuginosum*, (*d*) the green spruce aphid, *Neomyzaphis abietina*, and finally (*e*) the oak aphid, *Myzocallis castanicola*. The two common forms of each aphis are described below. Both these forms are viviparous—*i.e.*, producing living young—one form is winged and the other wingless. Those who might require details of the terms used in the descriptions will find them in No. 2 of this series in this *Journal* for May, 1935.

The Black Citrus Aphid (Aphis citricidus).

The wingless viviparous female is approximately 2 mm. long and is black, often covered with a faint bloom. The antennæ or "feelers" are shorter than the body and are black except for some lighter patches, while the eyes are very dark red, almost black. The legs are fairly light in colour with black patches.

The winged viviparous female is approximately 2 mm. long and is black also. The eyes are very dark red, while the antennæ are dusky with light patches, and are almost as long as the body. The legs are light with black areas.

HOST PLANTS IN NEW ZEALAND.

Found so far only on citrus.

OBSERVATIONS.

In New Zealand this is the common black aphid of citrus, and appears to be present wherever its host plant is grown. The winter is passed in the normal summer stages on citrus, but the rate of development is so slow that the numbers of the insect appear to be very small. In the spring these colonies take on a new lease of life and the young growing portions of the tree rapidly become covered with the pests. Fortunately this aphid is much parasitized, otherwise it would prove to be a much more serious pest.

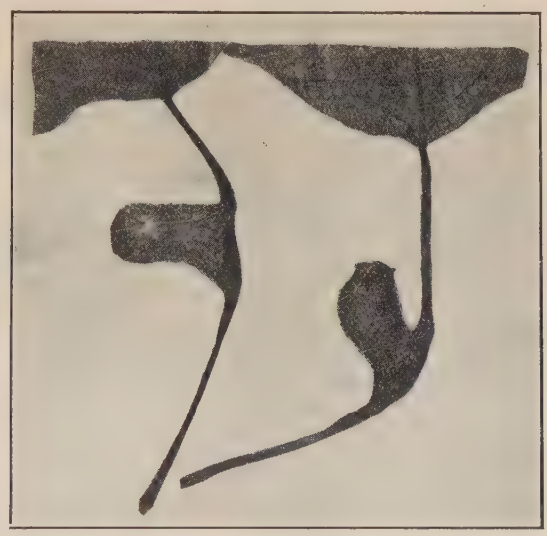

FIG. 1. GALLS ON LEAF PETIOLES OF POPLAR CAUSED BY PEMPHIGUS POPULI-TRANSVERSUS. [*After Miller.*

The Poplar-leaf Petiole Gall Aphis (Pemphigus populi-transversus).

The wingless viviparous female is from 2 mm. to 2·5 mm. long and in colour is a clouded pale yellow. The antennæ are very short, much shorter than the body. The legs are dark brown to blackish.

The length of the winged viviparous female is approximately 2 mm. The head, antennæ, and thorax are black, while the legs are also black. The abdomen is a clouded light greenish-yellow without markings, the whole body being coated with a light covering of grey powder. The antennæ are much shorter than the body, and the wings are slightly smoky.

HOST PLANTS IN NEW ZEALAND.

Poplar.

OBSERVATIONS.

This aphid is the cause of the formation of characteristic galls on the petioles of poplar-leaves (see Fig. 1). These galls are from ½ in. to 1 in. long when full-grown and are hollow, being provided with a small mouth-like opening at one end. Wingless females are the inhabitants

of these structures. During the late summer and the autumn winged aphides appear in the colonies and escape from the galls by means of the openings. These winged aphides fly to cruciferous plants such as rape, turnip, cabbage, and various cruciferous weeds, and thereon produce colonies of wingless aphides which migrate to the roots, the winter being passed underground in this way. In the spring winged forms make their appearance in the root colonies and these fly back to the poplars and produce male and female forms. This is the only time of the year at which the male is to be found. Each female lays a single egg. The individuals which hatch from these eggs settle on the petioles of the young developing leaves and cause new galls to form, inside which the aphides are soon enclosed.

FIG. 2. GALLED ELM-LEAVES CAUSED BY ERIOSOMA LANUGINOSUM.
[*After Miller.*

In this country, as a rule, this aphid causes no appreciable economic loss, the only apparent effect being the disfiguring of the leaf petioles of the poplar.

The Elm-leaf Gall Aphid (Eriosoma lanuginosum).

The wingless viviparous female is green to black and is approximately from 1·5 mm. to 2 mm. long. The body is shiny, with much mealy and white cottony material. The eyes are small and black. The antennæ are much shorter than the body.

The winged viviparous female has the head and thorax black, with the abdomen also dark. The whole body is mealy, and white cottony filaments are produced from the posterior portion. The eyes are black but are much larger than in the wingless form. The length of the body is from 1·5 mm. to 2 mm., while the antennæ are much shorter than this.

HOST PLANTS IN NEW ZEALAND.

European elm and pear.

OBSERVATIONS.

This aphid causes the formation of galls on the leaves of the elm (see Fig. 2). In the winter these galls often commonly persist on the tree as black dried remains, and are quite conspicuous when all other normal leaves have been shed. The aphides live inside these malformed leaves, the interior of the nests also containing a quantity of mealy and waxy substance or sticky fluid. The life-history of this insect in New Zealand has been worked out by Dumbleton (*N.Z. Jour. of Sci. and Tech.*, Vol. XVI, No. 3). Overwintering on the elm takes place in the egg stage. In the spring the eggs hatch and the young commence feeding on the developing leaves, and so cause the formation of galls which by the first week of November are quite small. The galls are fully grown about mid-December, and at this time winged aphides appear in the colonies and are ready to migrate. This migration takes place to the roots of pear-trees. Several generations are produced on the pear roots until the autumn, when winged forms fly back to the elm to produce sexual forms which lay the overwintering eggs, and so the cycle is completed. Colonies of the wingless aphides may also overwinter on the pear roots without having recourse to the egg stage. It is stated that on pear this aphid can cause severe damage, but in New Zealand experience with this species is very limited, and the insect does not seem to be of great importance as yet.

The Green Spruce Aphid (Neomyzaphis abietina).

The wingless viviparous female is green and from 1 mm. to 1·5 mm. long. The eyes are red and the antennæ dusky, these latter being approximately half the length of the body.

The winged viviparous female is light green, with the head and thorax darker. The eyes are red and the antennæ dusky, these latter being almost as long as the body, which is from 1 mm. to 1·8 mm.

HOST PLANTS IN NEW ZEALAND.

Spruce.

OBSERVATIONS.

This aphid causes injury to the spruce by sucking the sap from the needles. Very severe damage can be caused, badly attacked trees being severely defoliated (see Fig. 3). The insect is distributed over both the North and the South Islands. According to Dumbleton (*N.Z. Jour. of Sci. and Tech.*, Vol. XIII, No. 4), the numbers of this aphid on the spruce are scarce during the summer, but increase through the winter up to November, after which month the numbers decrease again until the winter. Thus breeding continues throughout the year, there being no egg stage.

The Oak Aphid (Myzocallis castanicola).

The wingless viviparous female is yellow to yellowish-green, ornamented with black spots, and presents a somewhat flattened appearance. The eyes are black, while the antennæ are yellowish with dark bands, and are shorter than the body. The length of the insect is from 1·5 mm. to 2 mm.

The winged viviparous female is usually pale yellowish or greenish, ornamented with dark patches. The eyes are very dark. The antennæ are pale, ornamented with dark rings, and are almost as long as the body, which is approximately 1·5 mm. The body bears several tubercles.

FIG. 3. SPRUCE KILLED BY NEOMYZAPHIS ABIETINA: OREGON PINE ON EACH SIDE UNATTACKED. [*After Miller.*

HOST PLANTS IN NEW ZEALAND.

Oaks.

OBSERVATIONS.

This is a very common aphid, it being possible to find the insects on almost any oak foliage during the summer. Although it is so common, it does not seem to cause much injury. It is very

probable that the species lays eggs at the bases of the buds on oak-twigs to carry over the winter. The writer has found aphid eggs in such places on oak, but is not certain that they are of this species.

Control.

For the control of the black citrus aphid, spray with nicotine sulphate 1 part to 800 parts of water plus soft soap at the rate of from 3 lb. to 4 lb. per 100 gallons of spray. However, the ordinary summer oil spray 1–60 used for red-scale on citrus will also control the black aphid. For the other aphids mentioned in this paper no chemical treatment is suitable on a large scale, the cost being prohibitive.

However, for ornamental trees use a spray of nicotine sulphate 1–800 plus soft soap as mentioned above. Summer oil may also be used at the rate of 1 part to 80 or 100 parts of water.

Conclusion of Series.

This article concludes the series on the aphides, as all those species of sufficient economic importance have been treated. Actually there are many more species in the Dominion, and it is hoped to publish complete information on them at a later period.

EELWORM DISEASE OF CHRYSANTHEMUMS.

W. D. Reid and W. Cottier, Plant Research Station, Palmerston North.

In March of this year a serious disease of chrysanthemums in the Palmerston North district was reported to this Station. On inquiry it was found that the disease first appeared after a period of heavy rainfall and high humidity prior to the 1st of January, but at that time only a few plants were affected and little attention was paid to the initial outbreak. A survey in March showed that the majority of the gardens were affected, though the amount of disease present varied considerably. At this time the plants were fully grown and selection of buds had taken place in preparation for show purposes. Many of the growers had been watering heavily and applying liquid animal-manure to force the plants, and in these gardens the disease was worst. Where the plants had not been so forced or where varieties, as the single or decorative types, required less attention, the disease was negligible.

Symptoms.

The early symptoms consisted of leaf discolorations which showed as small areas $\frac{1}{8}$ in. to $\frac{1}{2}$ in. in diameter slightly darker than the normal leaf. At first these areas were scarcely noticeable, but later became reddish-brown, and finally dark-brown or black. In this latter condition the diseased areas were sharply delimited by the leaf-veins forming the characteristic symptoms of the disease (Fig. 1). The lowest leaves were the first affected, and usually those parts of the leaves adjacent to the petioles showed the first lesions (Fig. 2), from which the disease spread over the leaves and

to the foliage above. On those plants infected early in the season most of the lowest leaves were black and withered, there being only a few green or partly green leaves on the upper stem, while in many plants the flower-buds and pedicels showed blackened portions. The roots, stems, and midribs did not exhibit any discoloration.

Cause of the Disease.

Tests for the presence of pathogenic fungi, bacteria, and viruses gave negative results, but a microscopic examination of the blackened areas showed within the leaf numerous eelworms in all stages of development from egg to adult. Eelworms were also isolated from

FIG. 1. TYPICAL LEAF-LESIONS DUE TO EELWORM-INFECTION.

the small, slightly dark areas on the leaves, but were not found in the roots, stems, petioles, midribs, or the new shoots from the root stocks. These eelworms are minute, colourless, thread-like parasites, only visible by the aid of a microscope, and similar in appearance to the organism responsible for eelworm disease of bulbs.

According to advice received from the Imperial Institute of Entomology the causal organism is *Aphelenchoides ritzeam-bosi* Schwartz, which is a recognized parasite of chrysanthemums in other countries. According to European investigators this eelworm is strictly a plant parasite, but in the absence of a suitable host is able to remain alive for some years in the soil or in dried chrysanthemum-leaves, and once the soil is contaminated it is a source of infection for future plantings.

Infection of the growing plants takes place through the leaf tissue, the parasites moving from the soil up the outside of the stem and entering the leaves through the stomata or through injuries. This movement of the eelworms is assisted by, but not dependent on, moist warm conditions.

In addition to chrysanthemums other plants are attacked by this eelworm, and these form additional sources of infection should the soil be used subsequently for the growing of chrysanthemums. These hosts are *Adenostyles* sp., *Doronicum* sp., *Aster* sp. (michaelmas daisy), *Elsholzia cristata* Willd., E. Patrini Garcke, *Calceolaria* sp.,

FIG. 2. AN EARLY STAGE OF EELWORM-INFECTION OF CHRYSANTHEMUM-LEAF.

Callistephus sp. (China aster), *Gloxinia* sp., *Pentstemon barbatus* Roth., *Chelone barbata* Cav., *Oncium* sp., *Phlox Drummondii* Hook., *Ranunculus repens* Linn. (creeping buttercup), *Chrysanthemum leucanthemum* Linn. (dog daisy), *Rudbeckia* sp., *Senecio vulgaris* Linn. (groundsel), *Valeriana montana* Linn., *Verbena venosa* Gill. and Hook., *Dahlia* sp., *Zinnia elegans* Jacq., *Delphinium* sp.

Control of the Disease.

Apparently no completely reliable control of the disease has yet been devised, but the work of some investigators has suggested general recommendations which are helpful in reducing the amount of infection. All dead leaves and infected parts should be removed

from the beds and burned, while between seasons the beds should be disinfected or replaced with soil known to be clean. Steaming is the most satisfactory method of disinfecting soil, and for this purpose a pressure boiler and harrow are necessary, but the cost for small areas may be prohibitive. An alternative to steaming is the replacement with soil from an uncontaminated area, and this is satisfactory provided (1) the soil is replaced to a depth of at least one foot and (2) the paths and borders of the bed are also replaced. Soil treatments with chemicals for the control of chrysanthemum-eelworm appear to be of doubtful value, and would be used only when steam-disinfection and replacement of the soil are impracticable. Apparently the only treatment which may be effective is the use of carbon disulphide.*

The system of propagating chrysanthemums by cuttings adds to the difficulty of controlling the disease, for by them the disease is often transmitted from season to season. The cuttings should be washed to remove adhering soil, dipped in a lime-sulphur plus colloidal-sulphur spray,† and struck in eelworm-free soil. During the growing period, both before and after planting out, the plants should be sprayed at least once each week with the above spray, which is also of service in controlling mildew and rust. A strong solution of nicotine sulphate (1–400) is also suggested as a good spray immediately after planting out, but frequent applications for two or three weeks are necessary. Another method of control is to prevent the eelworms from ascending the plants by placing a ring of vaseline or birdlime around the stem. This ring should be renewed as the stem increases in thickness, and care must be taken to prevent the lower leaves from touching the soil or adjacent plants.

Since no one method alone seems to be a satisfactory control for the disease, it is advisable to adopt a number of the above suggestions. At the present time some of these are carried out in part, but not with sufficient thoroughness to prevent the spread of the parasite.

In addition, growers should be careful when handling plants not to transfer infection by hands or implements from the ground or from one plant to another. Last season it appeared that indiscriminate handling increased the spread of the disease and was largely responsible for the transmission of eelworms to the flower-buds.

Summary.

A disease of chrysanthemums new to New Zealand is due to infection by eelworm, probably *Aphelenchoides ritzema-bosi* Schwartz.

The symptoms are shown in the blackening of the leaves and portions of the flower-buds, while the roots, stems, and midribs are not affected.

* Carbon disulphide is used at the rate of 14 fluid ounces per 3 square yards, ½ fluid ounce being injected every foot over the area to be treated. The injection holes should be made from 4 in. to 6 in. deep, and immediately after the introduction of the carbon disulphide each hole must be filled in. The bed subsequently should be covered with sacking for twenty-four hours. This treatment should be applied a few days before planting the bed. *Caution*: Carbon disulphide is poisonous, inflammable, and explosive, but when handled carefully there should be no danger to the operator.

† Lime-sulphur 0·083 per cent. polysulphide content plus colloidal-sulphur at 2 lb. per 100 gallons.

Soil treatments suggested to reduce the amount of infection are steam disinfection or replacement of the soil, or, where these are impracticable, the injection of carbon disulphide.

Cuttings should be washed free of soil, dipped in lime-sulphur-colloidal-sulphur, and propagated in eelworm-free soil.

Constant spraying with lime-sulphur plus colloidal-sulphur is advocated, and applications of strong solution of nicotine sulphate in the early growth stages are also suggested.

Ringing the stems with birdlime may be useful.

Finally, the indiscriminate handling of plants is to be avoided.

FIG. 3. CHRYSANTHEMUM SHOWING THE EFFECT OF INFECTION.
Note withered basal leaves and destruction of one flower-bud.

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THE GERMINATION OF PERENNIAL RYE-GRASS IN THE SOIL AND IN THE LABORATORY.

E. O. C. HYDE, Assistant Seed Analyst, Palmerston North.

IT may be superfluous to state that in testing the germination of agricultural seeds the object is to determine the capacity of the seed to produce plants when sown in soil under favourable conditions. The most direct method of achieving this object is to use soil as the medium for germination tests. However, from considerations of economy, urgency, and the necessity for uniformity of treatment, the testing of seeds for germination is carried out not in soil, but under highly artificial conditions. The temperature, and the supply of moisture, air, and light, are all controlled, and each kind of seed is placed under those conditions which much experimenting and long experience have shown to be most conducive to complete and rapid germination.

The utility of tests made under these artificial conditions depends on the degree to which such tests can be relied upon as a measure of the capacity of the seed to produce plants under favourable soil conditions. It is therefore imperative that the comparative results of germination in soil and under the standard artificial conditions in the seed-testing laboratory should be investigated as fully as possible. Only with the aid of such information can the most effective use be made of the results of germination tests.

The present article records the results of a series of these comparative tests in which a number of samples of certified perennial rye-grass seed were employed. It was thought that these results would be of interest in view of the frequent assertions that laboratory germination tests do not provide a reliable means of gauging the germinating-capacity of perennial rye-grass seed in the field.

One hundred and eight samples of certified perennial rye-grass seed were collected, including samples from all the main seed-growing districts. Samples of high and of medium germinating-capacity were well represented, but comparatively few samples of very low germinating-capacity were available. The samples were all of the 1934 harvest. The tests were made in September and October, and therefore the possibility of the results being influenced by incomplete after-ripening can be dismissed.

For the laboratory tests three lots of 100 seeds from each sample were used. The seed was incubated on moist filter paper in a chamber-germinator. The temperature was raised to 25° C. during the day and allowed to fall to 18° C. at night. The "interim" count was made on the sixth day and the final count on the twelfth day.

For the soil tests a light sandy loam was used. This had previously been heated in a steam-sterilizer sufficiently to kill most of the weed-seeds. Four lots of 100 seeds were employed for each test. The seed was sown about ½ in. deep and in straight drills to facilitate counting. The soil was kept in a moist condition, but the boxes were preserved by means of a cold frame

from excessive soaking and from interference by birds. In short, an effort was made to provide conditions uniformly favourable for germination and seedling establishment. The seedlings began to appear on the eighth day, and counts were made on the fourteenth and twenty-first days. There was seldom any additional germination after the fourteenth day.

The results for the germination tests in the laboratory and in soil are presented concisely in the correlation diagrams (1) and (2).

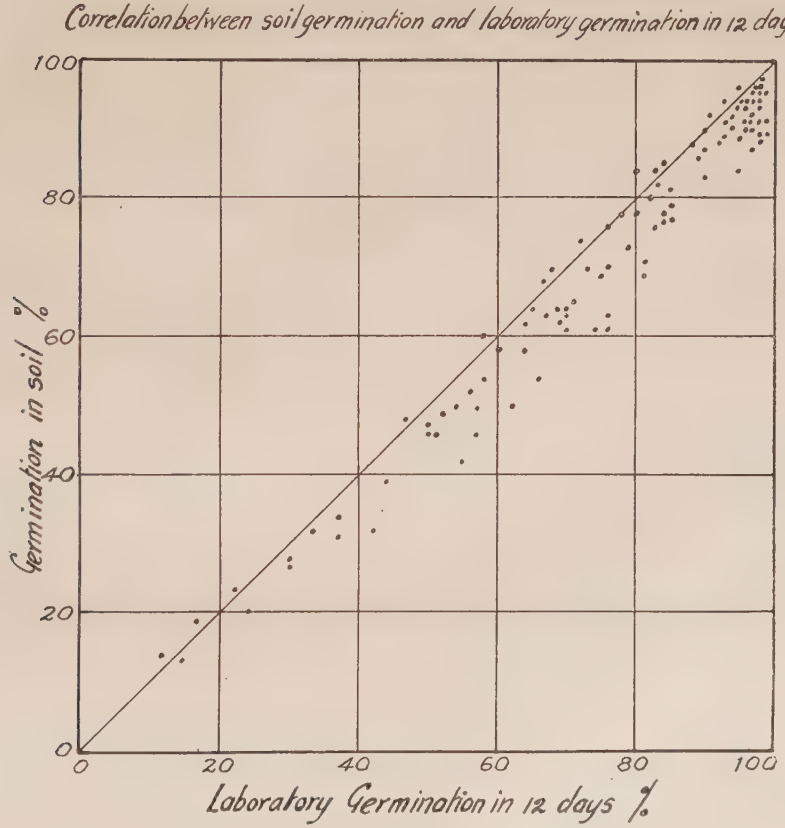

DIAGRAM 1.

In diagram (1) each sample is represented by a dot. The position of the dot measured on the vertical scale indicates the percentage germination in soil, while the position of the dot on the horizontal scale indicates the germinating-capacity in the laboratory. Dots lying above the line running diagonally from left to right denote samples of which the percentage germination in the soil exceeded that in the laboratory. The converse applies to samples represented by dots lying below the diagonal line. Diagram (2) in a similar manner demonstrates the correlation between percentage germination in soil and percentage germination in the laboratory

in six days. In the generalized diagram (3) the percentage germination in the laboratory is plotted against the ratio of the germination in soil to that in the laboratory, the germination in the laboratory being taken as 100. In the table the samples have been grouped according to their germinating-capacity in the laboratory. The average percentage germination and also the ratio of soil germination to laboratory germination are shown for each group.

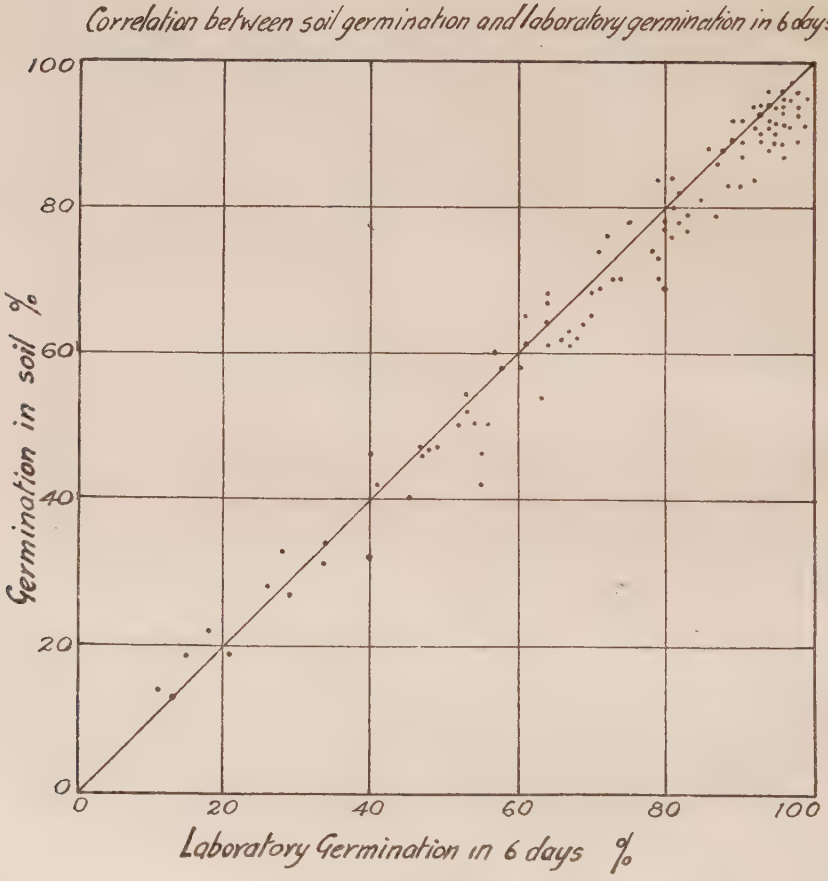

DIAGRAM 2.

Results of Comparative Germination Tests in Soil and in the Laboratory.

Laboratory Germination in Twelve Days (per Cent.).	Number of Samples.	Average Germination (per Cent.).			Ratio of Soil Germination to Laboratory Germination.	
		Laboratory, Six Days.	Laboratory, Twelve Days.	Soil.	Laboratory Germination in Six Days = 100.	Laboratory Germination in Twelve Days = 100.
0 to 40 ..	8	20	22	21	105	95
41 to 60 ..	16	46	50	45	98	90
61 to 80 ..	27	67	70	65	97	93
81 to 100 ..	57	90	92	88	98	95

It is apparent that the ratio of soil germination does not change markedly with different levels of germinating-capacity in the laboratory. When the twelve-day count is employed the ratio falls a little with decreasing laboratory germination until the samples of lowest germinating-capacity are reached, when the ratio rises slightly. When the six-day count is employed the ratio is more nearly constant at all levels of germinating-capacity, but again increases a little with samples of lower germinating-capacity.

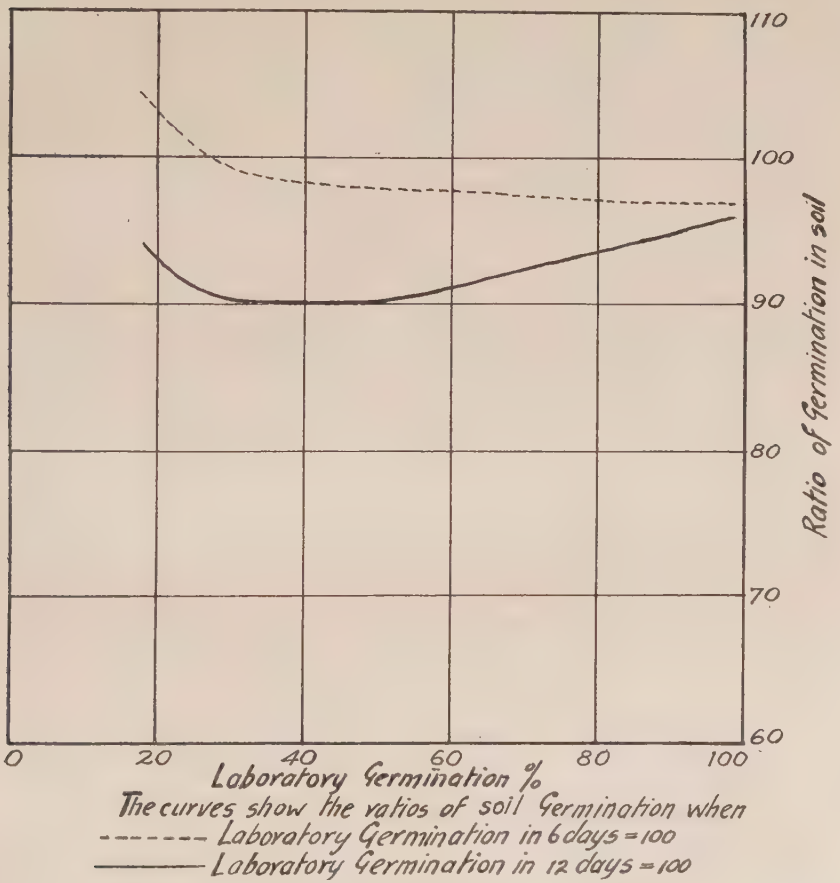

DIAGRAM 3.

In experiments of this kind it is generally found that the ratio of soil germination to laboratory germination falls considerably with decreasing germinating-capacity. Consequently, when sowing seed of low germinating-capacity it is usually necessary, in order to produce satisfactory results, to increase the rate of sowing to such an extent that the quality of pure germinating-seed used is much greater than would be required if seed of high germinating-capacity were sown. In explanation it is assumed that the influences which have caused the death of a proportion of the seeds have also

impaired the vitality of those that remain alive. This explanation appears satisfactory where the low germinating-capacity is the result of age or of unfavourable harvesting or storage conditions.

An examination of the data presented here shows that the generalizations outlined above are not always applicable to rye-grass seed. The samples of rye-grass seed of low germinating-capacity are peculiar in that they show a ratio of soil germination to laboratory germination as high, or indeed slightly higher, than is the case with seed of high germinating-capacity. The samples dealt with in the present work were only a few months old, and there was no evidence of excessive injury at harvesting or in storage. The low germinating-capacity of some of the samples was due in a great measure to the attacks of a parasitic fungus which invades the developing seed.* The vitality of the seed which has escaped destruction seems to be in no way impaired. It may be expected confidently when rye-grass seed of low germinating-capacity is used that if the rate of sowing is adjusted in inverse proportion to the germinating-capacity the seed will give satisfactory results in the field.

The present work has shown that the standard laboratory technique employed in germination tests of perennial rye-grass seed is satisfactory, and that results of laboratory tests serve very well for practical purposes as a direct measure of the comparative germinating-capacity in soil. For this purpose the "interim" count in six days is somewhat to be preferred to the final count.

The appreciably higher ratio of soil germination to laboratory germination for samples of low germinating-capacity is of some technical interest. It is unfortunate that so few samples of very low germinating-capacity were available. An effort is being made to procure a larger number of such samples in order that the matter may be investigated further.

* HYDE, E. O. C.: Germinating-capacity of Perennial Rye-grass Seed. *N.Z. Journal of Agriculture*, *44* (5); 316–319; 1932.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 5th September, 1935, to 19th September, 1935, include the following of agricultural interest:—

No. 74386: Horse-shoe; M. van Gestel. No. 74416: Power-taking-off gearing; Andrews and Beaven, Ltd. No. 74421: Implement-handle; Baker, MacPherson, and Co., Ltd. No. 71752: Grab-hook; W. Grant and R. I. Brake, No. 73213: Cleaning animal intestines; R. J. Bartley and S. H. McCartney. No. 73239: Animal-trap; S. H. Knapp. No. 73337: Separator-clutch; C. T. Foote. No. 73407: Teat-cup claw; A. B. Robertson. No. 73483: Separator-clutch; Cognate with No. 73337 above. No. 73899: Weighing of animals; C. Smith. No. 74103: Emulsifying hydro-carbons; M. F. Lamb.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

For the first time, the annual value of pig-meat exported exceeded £1,000,000, 485,677 cwt., valued at £1,313,502, being exported for the year ended 30th June, 1935, the corresponding figures for the previous years being 397,031 cwt. and £950,183.—*Minister of Agriculture, Annual Report.*

THE EARLY PROGRESS OF THE ROMNEY LAMB AND FEATURES IN THE DEVELOPMENT OF THE FLEECE.

F. W. DRY, Massey Agricultural College, Palmerston North.

THE purpose of this article* is to describe certain features in the early development of the fleece which have been the accompaniment of poor growth of the lamb. These features are to be attributed to external factors causing the lambs to grow slowly, sometimes very slowly, rather than to inherited make-up, for seasonal and feed conditions, or the total complex of non-genetic factors, were unfavourable, though it is true that some of the lambs here reported upon grew less well than other lambs kept with them.

It is not possible to state that particular early conditions bring about a specified loss of profit from the fleece. What it is desired to explain is that certain definable features can be correlated with poor progress of the young lamb, so that unfavourable conditions at the beginning of the animal's career appear to have marked effects upon the coat. We may therefore think of the skin and the fibre-roots as responsive to the treatment bestowed upon the lamb. It is this sensitive response to external factors which it is sought to emphasize.

An understanding of the effect of non-genetic factors on the lamb's coat is desirable so that we may ultimately know: (i) How to make allowance in selection for the effects of environment and nutrition; (ii) what are the results in profit and loss from the fleece of variations in the ordinary conditions to which young lambs are exposed; and (iii) how to modify to our own advantage—it may be by some very artificial device—the normal growth of the fleece.

The recognition of the different fibre types which have been described in earlier papers has made it possible to observe the details in the development of the coat of the lamb which are to be presented. Some of these features are of a kind not possessing obvious direct practical interest, but the failure to add new fibres to the fleece at a time when normally there is an increase in the number of fibres may be cited as a matter which merits investigation from the standpoint of fleece weight.

The features accompanying poor growth of the lamb are more marked in some fibre types than others. On present evidence it does appear that the first-founded follicles—those of halo-hairs—can stand up well when the lamb is growing poorly, whether before birth or afterwards. In sickle-fibres and in curly-tip fibres certain features can be correlated with poor growth in the early weeks of life, and it is concluded that histerotrichs—fibres without definite curls in the tips—may actually be prevented from beginning to grow in anything like normal abundance. It appears, therefore, that the later it be the turn of a follicle to develop the greater tend to be the effects of the factors causing a lamb to grow abnormally badly.

* Earlier articles on the coat of the Romney lamb have appeared in this *Journal* in 1933 and 1934.

The statements now to be made about the various classes of fibres have reference to the middle-line of the back near the level of the attachment of the last rib. It is this region of the body which has been studied more closely than any other.

Halo-hairs and their Successors.

Halo-hairs.—As indicated already, there is very little in the performance of the follicles of halo-hairs, whether these follicles be growing halo-hairs or later fibres after the shedding of their first occupants, that can be correlated with poor growth of the lamb. It will be explained in dealing with sickle-fibres why the shedding of these fibres, in contrast with persistence or indeterminate growth, is looked upon as an expression of vigour on the part of the follicle. It is a very rare happening for a halo-hair not to be shed, and when the growth of a few halo-hairs has been persistent it has not been possible to connect this with poor growth of the lamb. With sickle-fibres, as will be reported directly, the position is different.

It was suggested to me by Mr. A. Leslie, of Lincoln College, that pre-natal conditions may affect the abundance of halo-hairs. It is likely that the same kind of follicle is the potential producer of a halo-hair, a super-sickle-fibre, or a sickle-fibre. The belief that this is so is based primarily on Miss N. Galpin's study of the pre-natal development of the coat. Another reason is that halo-hairs are very occasionally persistent in growth, and an additional piece of evidence comes from the study of fibre succession in the follicles or birthcoat kemps. Commonly enough halo-hairs are followed in the same root by shed hairy fibres—that is, by secondary kemps—and so now and again are super-sickle-fibres, but very rarely indeed do kemps follow shed hairy sickle-fibres. In one only out of some eighty lambs was there evidence that this occurred, but in this exceptional animal there was enough secondary kemp amongst the immediate successors of the shed birthcoat kemps for all the shed hairy sickle-fibres to have been succeeded by kemps. This single lamb, however, lends considerable support to the view that the follicles of halo-hairs and of sickle-fibres are not of essentially distinct sorts.

In her work on the pre-natal development of the coat Miss Galpin often has occasion to think in terms of density of follicles in the expanding skin. In view of this, and of the conclusion stated in the last paragraph, it would be easy to understand how different rates of growth of the fœtus could help or hinder the first-founded follicles. If the original follicles became crowded through poor expansion of the skin we could understand how they might give rise to smaller fibres, to super-sickle-fibres, or sickle-fibres instead of halo-hairs. If, however, the increase in size of the lamb were much below normal just after the earliest follicles had been laid down we could suppose the founding of further follicles to be hindered and then we could understand how the earliest follicles, being left in consequence with more ample room in their early stages, might the more readily give rise to halo-hairs. The evidence now to be given on the point under consideration may most safely be said to be merely negative, but if it be indeed that poor pre-natal growth of the lamb has little or no effect on the abundance of halo-hairs this will be a contribution to our understanding of the architecture of the fleece.

In 1931 the lambs born in my breeding-work at the Massey College were weighed as soon as they were found in the paddock during their first twenty-four hours. The average birth-weight of lambs with no halo-hairs on the back (Grade 1) or with few (Grade 2) was less than that of lambs with medium numbers or many (Grades 3 to 6), the difference being three and a half times its probable error. In the first group, with no halo-hairs or few, out of ninety-five lambs sixteen weighed 7 lb. or less, but in the group with more halo-hairs only one out of forty-two was so light. These differences between the groups may be real, but they are by no means certainly more than a matter of chance.

At the Canterbury Agricultural College at Lincoln in 1934 more extensive material was very kindly placed at my disposal by Professor R. E. Alexander, Mr. Leslie, and Mr. D. J. Sidey. There I graded more than a thousand lambs by Southdown rams from a variety of ewes, including Romneys, Border Leicesters, Corriedales, half-breds (longwool cross Merino) and three-quarter breds (longwool cross half-bred). The breeding of the lambs at the two colleges was, of course, different, but the halo-hairs on the lambs at Lincoln College were to all appearances the same as those of Romneys. In the South Island lambs it came about that animals weighing 7 lb. or less were plentiful because many of the ewes had been kept in hard conditions in accordance with a research scheme on very different problems. In this abundant material the proportion of lambs weighing 7 lb. or less at birth was actually less amongst animals with no halos or few on the back than in lambs with more than few. Thus, of Mr. Leslie's experimental lambs with no halos or few, 151 were light, 702 were heavy; of these, with more than few, nineteen were light and forty-two heavy. This difference between the two groups, however, like any difference in average weight, is not statistically significant.

At both colleges twins were much more plentiful amongst the lambs of 7 lb. or less than in heavier lambs, but no light was thrown on the problem by examining the distribution of singles and twins in the "None or few" group and in the "More than few" group.

An analysis was made of data for the britches of the Lincoln College lambs. On the britch the numbers of halo-hairs per unit area are commonly much larger than on the back. Again the figures revealed no connection between birth-weight and grading for halo-hairs.

The best evidence of a connection between birth-weight and abundance of halo-hairs is afforded by a pair of twin Romney lambs born in 1932 in one of my breeding-experiments, both parents having had many halo-hairs. These lambs, which were born dead at what was known to be full term, were both extremely small and can have weighed only about 4 lb. each. None of my lambs with many halo-hairs has ever been so small as this at birth. These lambs were classed as Grade 2 (few) for halo-hairs on the back, but fibres, judged to be large super-sickle-fibres, were very plentiful. It is most unusual to find big-ended super-sickle-fibres abundant unless typical halo-hairs are plentiful, and it is therefore quite likely that in these twin lambs many fibres failed to become halo-hairs because the pre-natal development of the lambs was so poor.

The two lambs just described were, however, so abnormally small that they throw no light on the relation between variations in birth-weight ordinarily found and abundance of halo-hairs. Within the range of variation that is at all common the contemplation of the records

from the two agricultural colleges leaves the question of the relation between birth-weight and abundance of halo-hairs still open, and it does not appear very likely that any relation will be established.*

The whole question of the relation between the pre-natal progress of the lamb and the development of the fleece could be investigated to advantage in a breed showing less variation in coat-characters than the Romney.

Shedding of Successors of Halo-hairs.—The fibres following shed halo-hairs in the same roots are themselves sometimes shed, sometimes not. In a preliminary report (this *Journal*, June, 1934) a statement has been made about the shedding of these immediate successors of halo-hairs on the standard back position. In lambs with sickle-fibres in the array—that is, when the array is Saddle (or All-in), Ravine, Valley, or Plain—and with coarse hairiness in persistent birthcoat fibres not sustained definitely below the crisis level—that is, not produced beyond about the third month — free shedding of the immediate successors of halo-hairs is correlated with free shedding—usually three out of four—of sickle-fibres with large ends.

One lamb (E. 631 of 1932, Grade 4 for halos) in which a substantial majority of the big-ended sickle-fibres was shed grew very badly all the time, save possibly in the very early weeks, and died, miserably small, at seven months. By this time it could be ascertained, by pulling, where necessary, the fibres succeeding halo-hairs which had been marked by tying them, singly, in tiny bundles of other fibres, that nearly all the successors of halo-hairs were secondary kemps.

More recently succession on the back has been studied in the Plateau array, which includes no sickle-fibres, or such small numbers of them that they are regarded as not occupying a place in the array proper, but as standing in parallel. In this array the series runs from halo-hairs to super-sickle-fibres, to the biggest curly-tip fibres, which are often hairy in the pre-natal tip. Often the differences between the three groups of fibres, both in pre-natal and post-natal regions, are relatively slight, all being of lusty growth before birth and grossly hairy afterwards.

It is clear that for succession when the fibre-type array is Plateau it will be possible to establish an orderly generalization corresponding with that stated above for the other arrays. It has been concluded tentatively that in the Plateau array free shedding of the successors of halo-hairs takes place when there has been free shedding of a certain type of super-sickle-fibre. One lamb (E. 922 of 1934, Grade 6 for halos) with free shedding of those super-sickle-fibres grew badly, and was lamentably light at nine months, but in spite of this poor progress most of the successors of halo-hairs proved to be secondary kemps.

The shedding of hairy fibres, which are kemps precisely because they do shed, instead of continuing to grow, is thought of—to repeat an old statement—as a vigorous thing. Yet in the two lambs just reported upon in which the successors in halo-hairs were regarded, for the reason given, as destined to be shed, shed they were, in spite of prolonged poor growth of the animals. These two lambs were the only ones followed up in which free shedding of certain sickles and super-sickles occurred in animals which turned out to grow so poorly.

* That any such relation exists has become still less probable in the light of an analysis of birth-weight data from 110 lambs born in my 1935 breeding experiments on the inheritance of the abundance of halo-hairs. Nevertheless, the possibility must be recognized that the abundance of halo-hairs might be affected by non-genetic factors acting for a short time when the fœtus is comparatively young.

One other lamb (E. 545 of 1931, Grade 5 for halos, Ravine array) seems also to throw light upon the question under consideration. This lamb is known from weight records to have grown slowly for about its first three months, but afterwards, including the time when the successors of halo-hairs have completed their growth if they are to be shed, to have thrived better. Amongst other features to be associated with the poor progress of this lamb is the persistence of all the sickle-fibres on the standard back position. With none of the sickle-fibres shed one would ordinarily find very few of the successors of halo-hairs to be shed, whether or not the chalky region of the coarser persistent medullated birthcoat fibres extends—and in this lamb this does not happen—definitely below the crisis-level. Nor, indeed, in the conditions described would one expect the successors of the shed birthcoat kemps (halo-hairs and super-sickle-fibres) to show much hairiness.

In lambs making normal progress, with chalkiness not sustained below the crisis level, poor shedding of sickle-fibres, whether they be hairy after birth or finer, is attributed to the check given to their follicles at an early stage of development by the pre-natal check. This check is believed to impair at the same time the vigour of the halo-hair follicles, so that the fibre succeeding the shed halo-hair has a reduced chance of being a secondary kemp.

In E. 545 the successors of the halos and super-sickles actually prove to be decidedly hairy all round, and the numbers shed approach the numbers of halo-hairs. From evidence to be given a little later about the shedding of sickle-fibres the conclusion is drawn that the early hindrance to the growth of the lamb has resulted in the failure to shed of hairy sickle-fibres which otherwise would have shed. Nevertheless, it is apparent that the vigour of the halo-hair follicles has not been impaired. The conditions hindering the growth of the young lamb have not prevented the immediate successors of the halo-hairs from shedding. These facts from E. 545 are interpreted as additional evidence of the ability of the halo-hair follicles to resist an external factor which reduces the vigour of the follicles of sickle-fibres.

Delay in Appearance of Successors of Birthcoat Kemps.—For reasons published elsewhere, the starting to grow of a fibre is looked upon as making a big demand upon the vigour of the follicle, both in the mouse (*J. Genetics*, 1926) and in the sheep (Rudall, this *Journal*, 1934). One lamb (E. 187 of 1930, Grade 5 for halo, Valley array) had the misfortune to be weaned when only five weeks old, thereafter growing extremely badly, and eventually dying at eight months. At the standard back position the sickle-fibres all persisted. There was little hairiness in the curly-tip fibres. None of the successors of birthcoat kemps shed, and the successors were but little hairy. This lamb happened to be one chosen to have large numbers of halo-hairs marked on the back as part of the study of succession. From the search made at short intervals for the successors of these halo-hairs it was concluded that there was sometimes a delay of several weeks between the falling-out of a halo-hair and the protrusion of its successor above the surface of the skin, this delay being longer than any detected in other lambs.

Sickle-fibres.

Shedding of Sickle-fibres.—For a number of reasons the shedding of hairy sickle-fibres (*i.e.*, sickle-fibres that become chalky in appearance

owing to coarse medullation soon after birth), instead of persistent growth, is thought of as an expression of follicle vigour. This same belief is applicable, as indicated earlier, to other kemps. As explained in an earlier paper, a kemp is thought to shed because the follicle works so hard that it is forced to take a rest, whereas other follicles, producing very similar fibres that never attain such an intense pitch, continue their work without interruption. The following are reasons for regarding as due to vigour the shedding of hairy sickle-fibres and allied birthcoat kemps :—

(i) This belief is consistent with the view that hairiness is an expression of vigour, in the sense that material is put out by the follicle at too great a rate to be keratinized completely by that follicle. (See this *Journal*, May, 1933, Section "Non-genetic Factors affecting the Hairiness of Curly-tip Fibres.")

(ii) The more lusty a group of fibres is before birth, the greater the average proportion shed. Placed in order in both these respects are halo-hairs, super-sickle-fibres, sickle-fibres, and curly-tip fibres.

(iii) Some evidence is derived from the shedding of sickle-fibres in lambs having different fibre-type arrays on the standard back position. At this position in lambs now to be considered the chalky hairiness of persistent birthcoat fibres is not sustained appreciably beyond the crisis level—*i.e.*, that stage at which these sickle-fibres which are to be shed complete their growth. From the comparison of the backs of different lambs and from the comparison of the back and side of the same individuals it has been concluded that if chalky hairiness is sustained down the staple clearly below the crisis-level this tends to be accompanied by less free shedding of hairy sickle-fibres. It is indeed in such a condition, with the hairiness of the big, persistent fibres exceedingly coarse, that a few halo-hairs sometimes continue to grow instead of shedding. It would appear that the sustained general vigour with which the coarser fibres of the fleece are being grown enables sickle-fibre follicles which would otherwise have been compelled to desist from production, and so shed their fibres, to maintain their activity. The data now tabulated therefore have reference only to lambs in which pronounced hairiness ceases near the crisis level of the staple. The coat was protected on the back by a cover placed in position before shedding began. The lambs figuring in this table were mostly not weighed, but they were known to grow comparatively well ; the lambs of Table 2, "Growing badly," are not included here.

Table 1.—Shedding of Hairy Sickle-fibres.

Array.	Numbers of Lambs in which		
	Majority shed.	About Equal Numbers shed and persist.	Majority persist.
Saddle and All-in—			
All hairy sickle-fibres	15	1	..
Big-ended hairy sickle-fibres ..	16	..	..
Ravine—			
All hairy sickle-fibres	4	3	6
Big-ended hairy sickle-fibres ..	4	4	5
Valley—			
All hairy sickle-fibres	7	11	5
Big-ended hairy sickle-fibres ..	9	9	5

From this table it is suggested that in arrays containing fine sickle-fibres, or fine sickle-fibres and checked curly-tip fibres, fibres which are caused to be fine by the pre-natal check, the more intense pre-natal check tends to make it more difficult for hairy sickle-fibres to shed than in arrays in which the pre-natal check produces less marked effects on fibre form. That this be so, to state the matter simply, is indeed rendered very probable by the very fact that the fine sickle-fibres are not shed.

(iv) Curly-tip fibres have only been found to shed at all freely in the Saddle (including All-in) and Plateau arrays, those arrays in which the effects of the pre-natal check are the slightest.

On the evidence that has been set out we may conclude that the shedding of hairy sickle-fibres indicates vigour on the part of the follicles. What happens if the lamb grows very badly in the early weeks? The data in Table 2 are from only small numbers of lambs, but so far as they go they are suggestive. The lambs selected as growing very poorly averaged a gain of 0·3 lb. a day over approximately their first two months, while the lambs picked out as "growing well" amongst my experimental lambs gained 0·6 lb. a day, while a few included from a stud flock grew conspicuously well. In every lamb appearing in the table the shedding situation is the same whether we consider only big-ended hairy sickle-fibres or all hairy sickle-fibres. "Wool growing badly" means that some unusual feature of growth of the kind to be mentioned under "Curly-tip fibres" was noted. As in the preceding table, records are included only from lambs in which chalkiness ceased about the crisis level. The lambs were covered on the back.

TABLE 2.—SHEDDING OF HAIRY SICKLE-FIBRES.

	Numbers of Lambs in which		
	Majority shed.	About Equal Numbers shed and persist.	Majority persist.
Lamb growing badly; wool growing badly	..	..	7 (3 Ravine, 4 Valley).
Lamb growing badly; wool growing well	1 (Valley)	1 (Valley)	1 (Ravine).
Lamb growing well; wool growing well	7 (2 Saddle, 1 All-in, 1 Ravine, 3 Valley)	2 (1 Valley, 1 Plain)	..

It is to be mentioned that of the seven lambs growing badly with wool growing badly, in four no shed sickle-fibres at all were found on the back position. Some shed sickle-fibres have been found in all other lambs possessing, as do all those included in the tables, halo-hairs as well as hairy sickle-fibres on the back position.

The data presented suggest, therefore, that poor shedding of hairy sickle-fibres tends to accompany poor growth of the lambs in the first two months of life.

Fine Sickle-fibres.—In a small number of lambs with the array on the standard back position—Ravine, Valley, or Plain—fine sickle-fibres have been found that become somewhat coarser basally in, say, the third month, when the lamb was beginning to grow better, while other

fine sickle-fibres continue to be fine. The checked curly-tip fibres of Valley arrays have shown the same feature in lambs growing very badly indeed, when the cause of poor growth of the body is to be regarded as enhancing the effects of the pre-natal check.

Curly-tip Fibres.

In lambs growing badly the suspension of medulla formation at one time or another in the early weeks of life in persistent fibres in sickle-fibres and curly-tip fibres, chiefly the latter, for they are more numerous, has been placed on record in earlier papers. Such distributions of medulla down the staple, showing up strikingly in benzol, have been cited as conspicuous examples of the effect upon hairiness of non-genetic factors.

In regard to particular kinds of curly-tip fibres two types are to be mentioned. Firstly, checked curly-tip fibres have been dealt with in the preceding section, where it is explained that the special fineness of some fibres in the first couple of months of the lamb's life is to be attributed partly to the pre-natal check, and partly to whatever may be causing the lamb to grow so badly. Secondly, there are fibres in one lamb with the array on the standard back position Plain where there was the indication in the thickening of fibres after the age of two months that had the lamb grown normally the array would have been Valley. Here the poor growth of the lamb appears to be reflected in even those fibres that would have stood out as the coarsest curly-tip fibres in a fine-woolled animal.

As to the biggest curly-tip fibres in lambs faring badly, in body and fleece, in the autumn or winter, these fibres—peak curly-tip fibres—have been found to sustain their growth much better than other curly-tip fibres. This was so in E. 187, in which the wool grew miserably slowly in the late summer and early autumn, and in another of my experimental lambs, used by Mr. R. Waters in a study of wool-growth rate on the side, in which the coat grew very slowly indeed in part of the autumn and part of the winter.

Histerotrichs.

Amongst the lambs shown by weight records, as well as appearance, to grow very poorly during their first couple of months it fortunately happened that the coats of two were dyed on the back at birth and again six weeks later. During these first six weeks it is normal for considerable numbers of new fibres, non-curly-tip fibres, or histerotrichs, to be added to the coat. In these lambs the dyeing demonstrated the unusual scarcity of histerotrichs, almost none having made their appearance during those six weeks in one of the two animals.

Summary.

This paper is based upon comparatively small numbers of lambs, for whether their poor growth resulted from bad management or ill fortune the causes were not so catastrophic as seriously to affect large numbers of animals.

Unless it be in lambs light in the extreme at birth, it is improbable that any connection exists between small birth-weight and low abundance of halo-hairs.

It is likely that the cause of poor growth of the lamb does not prevent the successors of halo-hairs from shedding—that is, from being secondary kemps.

It is probable that the following features in the development of the coat are sometimes reflections of poor growth of the young lamb:—

Marked delay in the appearance above the skin of the successors of halo-hairs.

Poor shedding of hairy sickle-fibres.

Reduction at various early stages in diameter and medullation of sickle-fibres and curly-tip fibres which would otherwise have been consistently coarser and/or more hairy from soon after birth up to the age of two months.

Failure to add normal numbers of histerotrichs to the coat.

Conclusion.

In the work on Romney wool which has from time to time been reported upon in this *Journal* somewhat more prominence has been given to the inheritance of wool characters than to the effects of environment and nutrition. The results that have now been presented emphasize the potency of non-genetic factors.

A number of features described in the development of the coat of poorly growing lambs may reasonably be regarded as brought about by unfavourable conditions, especially insufficient food in a backward spring.

The recognition of the features described was made possible by a detailed study of the developmental history of the fibre types comprising the coat of the lamb.

To breeders it may be pointed out that the lambs growing badly now reported upon mostly grew exceptionally badly. Animals making such poor progress would not be likely to be retained as breeding sheep. The present work seeks to take advantage of extreme conditions in an attempt to recognize the effects of non-genetic factors.

AGRICULTURAL LEGISLATION OF 1934–35.

A. E. Morrison, Solicitor, Head Office, Department of Agriculture, Wellington.

In addition to the legislation of agricultural interest reviewed in the April issue of this *Journal*, the Canterbury Agricultural College Amendment Act, the Orchard-tax Amendment Act, and special provisions contained in section 5 of the Finance Act, 1934–35, extending the powers of the New Zealand Fruit-export Control Board in relation to the export of fruit, were passed by Parliament during the 1934–35 session, which was resumed in February last.

In the following notes the legislation under notice is reviewed.

Canterbury Agricultural College Amendment Act, 1934–35.

This Act validates the action of the Board of Governors of the Canterbury Agricultural College in borrowing moneys in excess of its statutory powers to borrow by way of overdraft or on temporary loan, and confers on the Board extended power, with the consent of

the Local Government Loans Board and subject to such conditions as the latter body thinks fit to impose, to so borrow moneys, but so that the amount owing at any time shall not exceed a total of £10,000. At the same time the statute imposes on members of the Board the same liability as to illegal borrowing as that imposed by the Local Bodies' Loans Act, 1926, on members of local bodies with regard to illegal borrowing by such bodies.

Orchard-tax Amendment Act, 1934–35.

This statute increases the rate of the orchard-tax imposed for general purposes from 1s. to 2s. per acre or part of an acre of the area comprised in any orchard. The proceeds of the increase in the tax shall be under the control of the Department of Scientific and Industrial Research, and shall be applied by that Department in assistance of scientific researches or experimental work in relation to the storage or transport of fruit or generally in relation to the fruit-growing industry.

Finance Act, 1934–35, Section 5.

Section 5 of this Act authorizes the New Zealand Fruit-export Control Board to establish a special reserve fund called "The Fruit-export Guarantee Fund" out of moneys received by the Board by way of levy or in respect of the sale of fruit or received expressly for the purpose of the Guarantee Fund. The purpose of the Guarantee Fund is to enable the Board to make advances to producers to a maximum rate per case of fruit exported as fixed by the Board. Where the price realized on account of any producer is less than the total amount advanced to him out of the Guarantee Fund, the difference shall be deemed to be a loan made to the producer, and such loan shall bear interest at such rate as the Board may determine. The amount of any loan deemed to have been made to any producer may be recovered by the Board out of any surplus received on account of that producer in any subsequent year or years. The Guarantee Fund may be given as security for overdraft moneys obtained by the Board to enable it to finance the shipment of fruit under its control and intended for export.

Bloat in Cows.—This condition was the subject of inquiry during the spring months, when the trouble is most experienced. Mr. Marshall, Veterinarian, Hamilton, carried out observations on its occurrence on several farms on the Waikato and Bay of Plenty Districts. It was noted that the trouble was invariably associated with an excess of white clover in the pasture and in a succulent, leafy stage. Access to water immediately after the paunch is filled with this soft clover seems to favour the occurrence of bloat. Probably for this reason bloating is frequently seen as often in the afternoon as in the early morning. The condition also received investigational inquiry at Wallaceville from an analytical viewpoint of the gas-formation in the paunch, and bacteriologically on the paunch-contents. The suggestion that the trouble might be associated with prussic-acid content of the clover does not appear to be established by investigation. Amongst preventive measures, the feeding of a small ration of dry hay in the morning, as a rule, is followed by good results. Acidulation of the drinking-water by the addition of a small quantity of dilute hydrochloric acid is spoken of as being effective, but this was not entirely borne out on inquiry.—*Director, Live-stock Division, Annual Report.*

SEASONAL NOTES.

THE FARM.

Pasture Utilization and Ensilage.

DURING November and December one of the greatest weaknesses in our pasture-management very commonly develops. This weakness lies in the production of flowering or coarse growth. Leafy pasture growth as a rule provides a highly suitable feed for milking-stock and for animals which are growing rapidly, whereas the stemmy or woody character that develops in flowering or coarse growth results in markedly poor feed for such stock. Leafy growth is characterized by a relatively high content of mineral matter which is required for the formation of milk and of bone, and a similarly high content of protein which is essential for the formation of milk and flesh. Further, leafy growth is much more digestible than stemmy growth—about 80 lb. out of each 100 lb. of the dry matter of leafy growth is digestible, whereas only from 40 lb. to 50 lb. out of each 100 lb. of the dry matter of stemmy growth is digestible. And that portion of the dry matter which is not digested is of no direct service in nutrition. Further, pastures which are allowed to become tall and stemmy in the first portion of the summer assume a relatively inactive condition during a considerable and critical portion of the producing season—*i.e.*, during late summer and early autumn—whereas pastures in which the flowering stage has not been allowed to develop to any great extent tend to produce leafy feed more continuously and in greater amounts during the critical period provided the growth on them is not too short at the advent of that period.

The condition of the pastures at the beginning of October suggests that this year the task of effecting the best practicable utilization of pastures will not call for attention as early as it usually does—in normal years between October and the end of the year on almost all farms devoted principally to butterfat or to fat-lamb production the effective utilization of pasture growth is likely to be an acute problem. If this problem has not been anticipated, it is at times difficult to deal with it satisfactorily, but, fortunately, if it has been anticipated suitably, then the timely taking of easy measures gives good results. On a great number of farms the key to the problem is ensilage. The work of ensilage is likely to be lightened greatly by intelligent preparation for important phases: for some of this preparation there is still ample time.

Preparation for Ensilage.

A main objective of the preparation for ensilage should be elimination of tedious avoidable labour—in this the provision of conveniently located trenches or pits is of great value. In the leading grass-farming districts there has been a significant increase during recent years in the number of trenches. This is because suitable locations for trenches, which are really modified shallow pits, can be found on most farms. Drainage is not of special moment in the sites of trenches, but naturally a really badly drained site should be avoided. Trenches usually can be made readily and cheaply with horse labour. Further, not only do they reduce the labour of handling the heavy green material, but they allow of its being compacted so well by trampling, &c., that the eventual wastage is reduced so much that it becomes virtually negligible. Full information about trenches and pits may be obtained from the officers of the Fields Division in the various districts.

Ensilage well justifies the use of labour-saving devices such as home-made or purchased sweeps and hoists. The man who undertakes ensilage without

the assistance of up-to-date equipment is a counterpart of the man who handles a large herd without the aid of the modern shed and milking-machine. This is of importance, because a substantial expansion in ensilage is distinctly advisable, and such an expansion will probably come only with the freer use of suitable equipment.

Weaknesses in Ensilage Practice.

Important faults in the making of silage may be summarized as follows :—

(1) Frequently the crop is harvested too late. This leads to unduly woody silage possessing, as to nutritive value, all the undesirable characteristics resulting from over-maturity in pasture growth. The ensiling merely preserves but does not improve the feeding-value of the material from which the silage is made. Indeed, silage as a rule is to some extent inferior in feeding-value to the green material from which it is made. Late harvesting gives less assurance of a substantial leafy aftermath, and a satisfactory aftermath frequently is of marked value during the late summer when supplies of leafy feed are likely to be scant. Further, late harvesting tends to bring about increased harm to permanent pastures because of the longer period during which shading and opening-up of the sward by the tall growth takes place.

Early ensilage is especially desirable in the case of the first cut of the season from a lucerne stand. This cut often contains a considerable number of plants invading the lucerne, and as a rule the longer such plants are left uncut the more they weaken the lucerne plants. Such plants typically are able to outgrow lucerne during cold conditions, but the increased warmth generally prevailing in the period following an early first cut enables the lucerne to outgrow them.

(2) Inadequate consolidation of the green material in pits and trenches leads to avoidable wastage following decay at the sides. It may be looked upon as practically impossible to bring about over-consolidation. The more mature and stemmy the green material the greater need for measures fitted to bring about consolidation : in this the weight of equipment and of workers can at times serve usefully.

(3) Development of excessive temperatures in the material leads finally to dark-brown or black silage instead of to the greenish to light-brown silage, which possesses more feeding-value, unless excessive wastage occurs in the liquid which may seep away from the silage. The amount of liquid that escapes from silage and the amount of loss associated with this liquid depends largely upon the amount of water originally in the green material. The seepage is apt to be greatest from silage made from material that is luscious or that is harvested in wet weather.

The high temperatures which lead to dark silage bring about not only avoidable wastage, but also substantial falling-off in value due to markedly heavy decrease in the amount of digestible protein.

(4) Inadequate or deferred covering of the stored silage with weighting material leads to avoidable surface wastage, which can be reduced by excluding the air as much as possible. The earth or other covering material should be placed on the silage practically as soon as gathering-in has been completed. Surface wastage frequently is excessive round the sides of stacks : as a means of lessening such wastage round stacks are to be preferred to ones of other shapes ; the thorough consolidation of the outside during the building of the stack and the bringing of the weighting material on the top right out to the edge of the stack also assist. These means of reducing external wastage, while simple, often are ignored in the field.

Ensilage alone insufficient to ensure Effective Control of Pastures.

The most judicious action practicable relative to silage does not always give completely satisfactory control of the growth of pastures. Frequently

it proves impossible in practice to gauge exactly the area of grass required to provide the feed required by the stock. Farmers who rightly believe in good feeding prefer to have some feed to spare instead of being undesirably short of feed. Surplus feed that may arise because of such an outlook may not be sufficient to allow of its being turned satisfactorily into silage, but nevertheless it may be sufficient, if not dealt with, to bring about unsatisfactory control of the growth of pastures. When this is so it is usually advisable to check the development of coarse and stemmy parts in a field by "topping" of the pastures—*i.e.*, by mowing to remove flower-heads. Often such topping is deferred until it is possible to obtain only little, if any, benefit from it, whereas if it were carried out at the right time it would give much benefit. Indeed, if topping is carried out too near to the advent of the dry summer period which usually occurs in many districts, and if the mowing is so close that it unduly exposes the soil to drying out during fine weather, then topping may give an undesirable result. Primarily the purpose of topping is the removal of flower-stalks and coarse growth, and it should lead to the minimum mowing of leafy growth fitted for milk-production. Further, topping should be looked upon not as a routine measure, but as an emergency one necessitated by more feed than was counted upon becoming available. From this it follows that if much topping becomes advisable in a normal season, then judgment was astray earlier in the season in that enough of the grassland was not closed for hay or silage. Because of its stemmy nature, the topped growth is not of high value for milk-production, but dry stock may well be employed to consume such growth; this they do readily when it has become partly wilted. Topping that involves the mowing of tall weeds may prove of much value by reducing the shading that is readily caused by such weeds and that tends to impair pastures by opening them.

For the thoroughly efficient control of the growth of pastures in summer, ensilage and topping need usually to be associated with systematic grazing. The essential features of systematic grazing, which is not at all intricate, are: (1) Rapid grazing of fields by relatively heavy stocking—*e.g.*, from six cows an acre upwards for one to three days; (2) subsequent complete "spelling" the pastures to allow of recovery. Systematic grazing of pastures does not call for grazing severe enough to punish either the stock or the swards. Neither does it call for unusually close subdivision of farms; splendid results have been obtained on farms on which from nine to twelve fields were under grazing.

Utilization of Sheep Pastures Important.

Experience has shown that the utilization of the summer growth of pastures is as important for fat-lamb production as it is for butterfat production. Hence ensilage as a means of avoiding coarse herbage on pastures in summer, as well as of obtaining assured supplies of winter feed, could be practised with great advantage much more extensively by sheep-farmers.

Forage-crop Production.

Some aspects of the important role of forage crops was discussed in these notes last month.

Three of the main factors begetting efficiency in the growing of forage crops are of current importance. One is the use of good seed. The saving of a few pence or even several shillings an acre on seed for forage crops is almost always parsimony instead of economy, in that such saving is commonly linked with the use of seed of any or all of the following characters: Poor germination, poor vigour, poor type, or poor strain. Any one of these characters may give rise to unsatisfactory financial returns.

A second factor which widely favours the production of profitable heavy crops is liberal manuring so as to bring the fertility of the land into conformity with the full producing-capacity of the crop. While the error of

undermanuring is widespread, that of overmanuring of forage crops is practically unknown. Many seem not to realize that even in the case of the least nutritious of popular forage crops the value of a ton of the crop is more than sufficient to pay for 1 cwt. of the fertilizers commonly used with them—*e.g.*, mangels, chou moellier, and swedes are worth about 10s. a ton if hay is worth £3 a ton, and from this it follows that an increase of 2 tons an acre in the yield of these crops due to the use of 2 cwt. an acre of fertilizer would be a profitable undertaking; and in practically all districts, but especially in districts of fair to good rainfall, observation and investigation have pointed to the likelihood of much greater increases in yield being caused by suitable manuring. The third factor that contributes towards success with forage crops and probably the most important is cultivation; without good cultivation the use of good seed and liberal manuring prove, to some extent at least, futile. It is seasonable to note that the cultivation adopted in the preparation of seed-beds is often greatly below the requirements of the crop to be grown.

Lucerne.

The great value of a successful field of lucerne warrants the utmost endeavour to secure the best possible results. A fine firm seed-bed is required for fully successful establishment of lucerne. Rapid and vigorous development of the seedlings, which contributes greatly to eventual complete success, is favoured by warmth, and, because of this need of warmth, sowing during the latter part of November or in December generally gives good results. It is good practice to sow, through every coulter of the grain drill, from 12 lb. to 18 lb. an acre of seed of Marlborough origin. A greater amount of seed is needed when the seed-bed is relatively poor. Alternatively the seed may be broadcast and covered by light harrowing. As a rule, lime may be applied with advantage before the final cultivation preceding seed-sowing. Treatment of the seed with a suitable culture is advisable in order to ensure the presence of specific organisms, upon the activity of which the ultimate success of lucerne depends. Cultures supplying these organisms are obtainable at a small cost from the Department of Agriculture. Full information about obtaining and using these cultures and about the establishment and management of lucerne is contained in Bulletin 155, which is obtainable free of cost from any office of the Department of Agriculture.

Mangel-growing.

The mangel has outstanding valuable characteristics which warrant a great increase in the acreage devoted to it in New Zealand. It is particularly dependable not only because during dry seasons it fares better than most other alternative crops, but also because it is not subject to any serious disease: occasional serious losses due to a rot have been noted, but these truly are exceptional and can be avoided. The mangel yields heavily if suitably treated: yields of from 50 to 60 tons an acre are obtained over wide areas, and the crop is relatively nutritious. It is of practical importance that if not suitably treated the mangel is likely to give disappointing results. Poor preparatory cultivation may readily limit the yield of the crop.

Judging from field experience, the variety Prizewinner Yellow Globe deserves its current popularity, which is based on its yield. Other varieties also, such as Red Intermediate and Golden Globe, have been giving good results. The mangel generally responds profitably to liberal manuring: a dressing of 5 cwt. an acre or more is frequently justified, and a mixture consisting principally of superphosphate and blood and bone dust in equal parts may be used with confidence. It is standard practice to sow about 6 lb. of seed an acre in rows from 26 in. to 28 in. apart, but some recent evidence suggests that somewhat closer rows may be advisable when the rainfall and the fertility favour heavy yields. Wet, cold conditions readily cause

poor strikes, and the date of sowing sometimes is too early, so that some delay in sowing to obtain warmer soil conditions is often advisable. Over wide areas November sowing is generally suitable. Between now and time of sowing, preparatory cultivation, to provide a good tilth and to maintain a loose surface layer of soil in order to minimize loss of soil-moisture by evaporation, is likely to be very valuable. The need of conserving soil-moisture as much as possible may be gauged from the fact that the equivalent of 30 in. to 40 in. of rainfall passes through the leaves of a crop yielding from 60 tons to 80 tons to the acre.

Field Carrots.

On free-working loams the field carrot is capable of heavy yields. Success generally attends sowing in November. Good results may be expected from a manurial dressing of from 3 cwt. to 5 cwt. an acre of a mixture consisting of 2 parts of superphosphate and 1 part blood and bone. Varieties which have been popular for many years are Matchless White, Barriball, White Belgian, and Guerande. Guerande, which is a very suitable variety for sheep or pigs, is grown successfully, without thinning, in rows from 21 in. to 26 in. apart, 1½ lb. of seed an acre being used. With other varieties good results frequently are obtained by hand thinning and cultivating carrots sown in rows from 21 in. to 26 in. apart, but sowing in 14 in. drills also gives heavy yields.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Pest and Disease Control.

DURING the forthcoming month a constant watch should be kept for the appearance of diseases, as with the advent of warmer weather a more extensive range of insect pests and fungous diseases has to be contended with. While spray applications at ten-day intervals were recommended in last month's notes, during the forthcoming period it is usual to lengthen the time between sprays. It is unwise, however, to extend the period between sprays too early in the season, and weather conditions should be the guide in this matter. It is preferable to make the first three applications following blossoming at fourteen-day intervals. Subsequent sprays may be spaced three weeks apart if conditions are favourable.

For the control of brown-rot of stone-fruit lime-sulphur at 0·083 per cent. plus colloidal sulphur 2 lb. to 100 gallons, as mentioned in last month's notes, should be continued at three-weekly intervals.

Varieties of pears which are susceptible to black-spot should continue to receive Bordeaux 3–4–50 plus arsenate of lead 1½ lb. to 100 gallons of spray at three-weekly periods. All other varieties should receive lime-sulphur at 0·1 per cent. plus arsenate of lead 1½ lb. to 100 gallons.

On apples the combination given last month—viz., lime-sulphur 0·1 per cent., colloidal sulphur 2 lb. plus arsenate of lead 1½ lb. to 100 gallons and 4 lb. of hydrated lime—is recommended for the next four weeks To reduce the risk of russeting on tender-skinned varieties, it may be wise to eliminate the petal-fall spray if weather conditions permit, otherwise it is advisable to apply the arsenate of lead apart from the lime-sulphur and colloidal sulphur spray.

A watch should be kept from now for the appearance of aphis, young scales, red-mite, leaf-hopper, &c., and the necessary steps should be taken for their control as early as possible. Frequently a prompt application will deal successfully with these pests, whereas one or more sprays when they have become established may fail to effect satisfactory control. One should remember that timely application is very important, as also is thoroughness of application.

Cultivation.

Cultivation should be pushed ahead as rapidly as possible in order to bring the ground to a good tilth as early as practicable. The maintenance of healthy foliage and the obtaining of good size in the growing crop is greatly assisted by frequent cultivation, especially during periods when dry conditions are experienced.

Thinning.

The thinning of the fruit crops will shortly be occupying the attention of growers. The importance of this practice in successful fruit-culture must not be lost sight of, and can hardly be over-emphasized. Too frequently thinning is looked upon by the grower as a job to be done if there is time, and often in consequence it has to give place to other work considered to be more important.

The benefits to be derived from careful and systematic thinning are as follows: Thinning and spacing of overcrowded fruit, thereby ensuring the better growth of the fruit and a more efficient spray covering; removal of diseased and blemished fruit, thus reducing the percentage of culls at harvest-time; and the elimination of under-sized fruit, thus ensuring a more uniform size in the remainder of the crop. As a result the crop is much less costly to harvest and prepare for market, and is of greater value through its improved quality.

The maturing of a well-thinned crop is much less exhausting to the tree and regularity of cropping is assisted, while the vigour and health of the tree is also maintained. No set rule-of-thumb methods can be laid down for thinning. It is customary to thin at least twice or three times during the season rather than to make a complete job at one operation. During the first thinning the aim is to lighten the load and to space the fruit by thinning the clusters. In the second and third thinnings further spacing of the fruit is attended to where necessary, and diseased and blemished fruit are removed. To secure the greatest benefit thinning should commence when each kind of fruit passes its period of natural drop. The person doing the thinning must be guided by the quantity of fruit set and the estimated ability of the tree to develop and mature a given quantity of fruit. In this experience alone is the best guide. However, it is a safe rule in thinning stone-fruit that when this work is completed no two mature fruit should be touching. This is important where brown-rot infection is experienced.

Short-stalked varieties of apples are usually thinned to singles, while with the longer-stalked kinds the clusters are thinned to two or threes, according to the crop and the vitality of the individual tree. When thinning on uncut laterals which have set fruit at practically every bud, it is wise to remove the fruit completely from every two out of three buds at least, and then thin the remaining clusters as indicated.

Fireblight.

During the coming month growers should be on the alert for the appearance of fireblight infection. Late-flowering varieties of both apples and pears should be closely watched for blossom infection. Infected blossoms become discoloured and hang on to the tree, gradually turning brown, and then black. Through fireblight being carried by bees and other insects, infection may be rapid at this stage and the loss of crop severe.

Following blossom infection the tips of the laterals may become infected. This condition is characterized by the infected tips curling and gradually turning black. Infected material should be removed and destroyed with as little delay as possible. In cases where the cause of the death of portions of the tree is not known, specimens should be submitted to the local Orchard Instructor for examination.

Grafting and Planting.

While it is advisable to have all grafting completed before this, late grafting may still be carried out, provided that the scions are kept dormant and that a branch or some low growth is left to absorb the excess of sap to prevent the "drowning" of the scions.

Scions on newly grafted trees require some attention. Where ties have been used an examination should be made to see that the ties are not cutting into the swelling scions. Where this is evident the knife should be run through the ties at the back of the graft, allowing the ties to be forced apart naturally.

To prevent damage by the blowing out of the growing scions by high winds it is advisable to tie these to some support or centre stake.

Newly planted trees should receive frequent hoeings to retard weed-growth and promote fine tilth. Any unnecessary shoots which develop should be rubbed off.

Frost Protection.

In districts where heating for frost protection is carried out growers would be well advised in a year such as this, where the occurrence of late frosts is likely, not to gather in the fire-pots until late into the season.

General.

As opportunity offers an early commencement should be made on odd jobs. Where tree-bandaging with chemically treated banding materials or sacking is adopted as a supplementary means of control of codlin moth, the bands should be examined and the grubs destroyed. Breeding-places for the moth in and around the packing-sheds should also be given attention. Rough bark under which the larvæ may be located should be scraped, and cracks and crevices cleared of any grubs.

The renovation of old orchard cases should be commenced. Packing-sheds should be cleaned up and made ready for the early reception of the new season's case material.

—R. G. Hamilton, Orchard Instructor, Hamilton.

Citrus Notes.

Every endeavour should now be made to attend to the cultivation; ground round the trees should be worked up fine, but care should be exercised so that the feeding-roots close to the surface are not unduly damaged. A careful search should be made for evidence of bark-blotch and collar-rot, and where these are discovered prompt treatment should be given by removing all diseased bark, including a small portion of healthy bark round the edges. The wounds should then be treated by painting over with Bordeaux paste, coal tar, or the bitumen preparation called "Colas." The past few months in northern districts having been wet, lack of proper drainage will be detrimental to citrus trees and favourable to the development of collar-rot.

As the spring advances young borers become active, and their presence is indicated by the withering of the leaves on affected twigs, or, where larger limbs are attacked, by the fresh castings. In the first instance the infected twig should be removed and the grub destroyed, and in the second a few drops of benzine should be injected into the holes and then plugged with soap. When the main blossoming of lemons is finished and the greater portion of the crop has set, a spray of Bordeaux 3–4–50 should be applied as a controllant of verrucosis and grey-scab, followed by a further application to cover the extended period of flowering. If scale other than red-scale is present the trees should be sprayed with a summer oil 1–40 to 1–80 according to the brand of oil used, and if red scale is present a further spraying with oil is necessary during January and February to coincide with the hatching of the young scales. Budding can be carried out during October or early in November, or may be deferred until the bark lifts freely in the autumn.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Parasites.

Now that the warm weather is approaching, poultry-keepers should pay extra attention to guarding against their birds becoming infested with vermin. Many chickens and young turkeys are lost each year through the ravages of parasites, especially where poultry are kept by people who are more or less uninterested, and it is regrettable that quite a number of poultry-keepers do not know the needs of their birds, and expect too much from them for the attention given. The efficient poultry-keeper does realize the importance of keeping his birds and their houses in a clean and sanitary state, just as the successful orchardist knows that it is unwise to expect any profit from his orchard if he does not do his part and keep his trees in a clean and healthy condition.

Insect pests play a very important part in the general health and productiveness of poultry, and chickens infested with vermin, whether with a hen or in a brooder, are always stunted and fall an easy prey to disease, and even if they do not become diseased they do not develop into profitable stock.

Pullets, if infested with vermin, do not grow as they should and may often fail to lay until they are nine or ten months old, and even then do not lay well. Cockerels or cock birds that are allowed to become infested with parasites are unsatisfactory as breeders, and when mated do not give good fertility. The setting hen, if troubled with vermin, may be driven from her nest or may become so thin that she will fail to effect a good hatch, and the food given her may produce looseness of the bowels.

Whenever hens or chickens appear listless, or are not thriving, although they have no definite ailment, it is well to examine them for lice, for there is nothing that is more detrimental to the health or growth of chickens than parasites, especially if they are allowed to get a foothold in large numbers.

Vermin attack poultry in different ways, and while some suck the blood, others irritate the skin by scratching with their sharp claws, while others again form crusts or scabs. The worst parasites are those that suck the blood, for the blood carries the nourishment to the different parts of the body, but if it is sucked by vermin the birds get little good from it. Those parasites that irritate the skin by crawling over and clinging to it with their sharp claws are also the cause of much trouble. These insects worry the birds day and night, giving them no rest, and the effect of the want of rest alone can well be surmised.

Houses that are dark, damp, badly ventilated, and full of cracks and crevices are breeding-grounds for poultry-parasites of all kinds. Scientists who have studied the life-history and habits of these parasites have stated that the third generation of a pair of red mite may amount to 120,000, and this increase will take place in eight weeks.

The poultry-keeper must continue fighting these pests all the year round, for if he relaxes his vigilance for a while the parasites may get such a hold as to upset his plans for a whole year. All parasites may be destroyed by the use of fumes, liquids, or powders. Practically all vermin, except the red mite, can be destroyed or kept in check by dusting fine powder into the fowls' feathers, but to destroy the red mite a liquid insecticide must be used. The powder used for dusting should be dry and as fine as possible, for the finer it is the more effective it becomes. A suitable mixture for the purpose can be made up of equal parts of lime, dry earth, and sulphur. Another good method of treating birds for insects is to dip the end of a feather into nicotine sulphate and draw this under the wings or among the breast feathers. Where a large number of birds has to be treated for vermin the better plan is to place a thin line of nicotine sulphate along the top of the perches just before the birds go to roost. Before applying the

nicotine sulphate it is advisable to wipe the perches with a damp cloth in order to remove any dust, thus preventing the liquid from running off and being wasted.

Scaly-leg is caused by the scaly-leg mites (*Sarcoptes mutans*) which attack the unfeathered portion of the leg above the foot, and often the top of the toes. The minute parasite crawls under the scales of the legs and there irritates the tissues for the purpose of obtaining food with the mouth parts. As a result of this irritation small blisters appear and, after a time, rupture. The serum dries and makes a minute scab, and as the parasites become more numerous they cause a piling-up of the scab. The itching is more intense at night, and the bird, if not treated, may become weak and even die. A good treatment for this trouble is to soak the legs in soap and warm water, when the scabs can be removed, and then rub in a mixture of sulphur and lard. The treatment should be repeated in about ten days' time.

Though the ravages of parasites may cause so much loss amongst young and old poultry, if the poultry-keeper sees to it that all perches are dressed each week or so during the warm weather with waste car oil, kerosene, or some other good liquid insecticide, and if the houses are kept clean and dry and plenty of sunshine allowed into the houses, he need not be afraid of parasites driving him out of business.

A Trouble with Brooder Chickens.

For several years past, about this time of the year, especially since the introduction of mass-production methods of chicken-rearing and the use of the large canopy brooders where four and five hundred chickens are reared in one lot, a number of poultry-keepers have had a trouble amongst their chickens known as green-leg, or green-wing. The first symptoms of this trouble are generally a swelling of the head or back of the neck, and on examination it will be found that the hock joints are swollen and discoloured, with the joints of the wings also often affected. When the neck and head are badly affected the chicken has difficulty in breathing, and death often follows. This trouble is really caused by incorrect night conditions, overcrowding, and insufficient ventilation, thus causing many chickens to rebreathe the same impure air. Like many other chicken ailments, this trouble is much easier to prevent then to cure. The best means of preventing the trouble is not to overcrowd and to provide plenty of good, dry bedding material—in fact, it is advisable to place some fresh dry bedding material under the hover each night after the chicks are three weeks old.

Where the frame is used to brood chicks on, as recommended in this Department's Bulletin No. 66, "Utility Poultry-keeping," it is well to raise it an inch or two off the ground after the chickens are a little over three weeks old, as this allows the air to get underneath the chickens, and so helps to avoid trouble. Where the frame is not used extra care should be taken to see that plenty of fresh bedding material is used; a little extra bedding material is much less expensive than the loss of a number of chickens.

Overcrowding is one of the chief causes of trouble amongst artificially reared chickens. The writer has seen four and five hundred chickens successfully reared under one brooder, but they have been handled by experienced poultry-keepers. The beginner would be wise to place not more than half that number under each canopy brooder, and in most cases thereby obtain much more satisfactory results. Everything should be done to avoid overcrowding and anything that is likely to create a moist atmosphere. A careful watch should be kept on the chickens just as they are camping for the night to see that they do not crowd. The cockerels should be picked out as soon as they can be detected, as this allows extra room for the pullets. It is also wise to encourage the chickens to perch

as soon as they are fit to leave the brooder. Leghorn chickens should, if well brooded, be ready for perching at between six and seven weeks old, but care should be taken to see that they are gradually hardened off.

Next Season's Breeding Cockerels.

It is now a good time to secure cockerels for next season's breeding-pens. Many large poultry-farmers are pleased to sell young cockerels as soon as they can be picked out. For a small outlay one could purchase, say, two or three times the number required—as they develop the poorer birds could be culled out and sold or used for table purposes.

—C. J. C. Cussen, Chief Poultry Instructor, Wellington.

THE APIARY.

Swarming.

By November, if the weather conditions are favourable, swarming should be in full swing throughout the Dominion. Therefore it is most important that the beekeeper should note the condition of his hives in ample time to decide which colonies are to be allowed to swarm. Excessive swarming is often accepted by beginners as a proof of prosperity, but this cannot be regarded by any means as an established fact. Only strong colonies headed by young vigorous queens should be allowed to swarm, and in many cases it will be found that these colonies show little inclination to do so. Where a colony of moderate dimensions persists in making preparations for swarming it should be requeened from better stock at the earliest opportunity.

When a strong colony swarms, the swarm should be hived at once into a clean box, in such a manner that the bees may pass in and out of the box easily, and be left there till towards evening. By that time a hive should be prepared containing frames fitted with full sheets of foundation, and, if necessary, a feeder, the hive being placed on its permanent stand. Late in the afternoon the hive-body should be raised from the bottom-board and a clean sack laid on the alighting-board and surrounding ground. The bees should be dumped from the box on to the sack, when they will crawl into the hive.

If honey is not coming in freely, or if bad weather supervenes, the swarm must be fed with syrup prepared from sugar and water, in the proportions of one to two, so that the bees may commence comb-building at once. Excellent combs are made from sugar-syrup, and within two or three days the bees should have drawn out several combs and the queen be busily engaged filling the cells with eggs. The bees in a swarm are prepared for comb-building, and simply waste much wax if placed at once on drawn-out combs.

If the beekeeper has any reason to suspect the hive from which a swarm issues to be diseased, he should leave the swarm in the box into which he has hived it for at least three days, in order that the bees may use up the honey they have brought with them when they left the parent hive.

After the swarm has issued the parent hive should be thoroughly examined, so that the queen-cells may be removed. Every cell except two of the best should be taken away. Where the hive contains particularly good stock, and the queen-cells are large and ripe, they may be carefully preserved and placed in nuclei for the purpose of queen-raising. Very often the best queens in the apiary are procured by this means. When the swarm has been placed in its permanent hive the frames should be carefully covered by good mats. Neglect of this precaution, even for two or three days, often results in the bees building comb right into the roof, especially where gable roofs are used, thereby wasting much good material as well as making the hive difficult to open.

After-swarms.

It often happens that in spite of all precaution strong colonies throw an after-swarm within a few days of the issue of the prime swarm. Sometimes the prime swarm may be delayed by bad weather, in which case the bees may keep the virgin queens in their cells until the laying-queen has left the hive, only to liberate them immediately after, and before the apiarist has time to examine for queen-cells. These queens, being small and of quicker movement, are very difficult to detect, and may readily escape notice altogether. In this case the after-swarm may follow very quickly after the prime swarm. Occasionally, too, a few queen-cells may be missed in cutting out. If they are built, as frequently happens, on the edge of the comb against the side of the frame they are very easily overlooked.

After a little observation an after-swarm can often be detected by its behaviour. A laying-queen is heavy with eggs, and usually seeks a resting-place without delay and without venturing too high from the ground. Sometimes, indeed, she falls to the earth, and the bees are unable to find her and return to the hive. However, she usually alights in some convenient spot, and the bees cluster round her with amazing rapidity. When the hives are scattered instead of being in regular rows, a beekeeper working in his apiary at a distance from a swarming hive may miss the whole operation of the issuing of a prime swarm unless the noise attracts his attention, so quickly, as a rule, do the bees settle with a laying-queen.

With one or more virgin queens in a swarm, matters are usually different. The queens are small and light, and often soar to a considerable height, choosing their own time about settling. If there are two or three queens in a swarm there are likely to be as many divisions in the cluster, so that instead of forming one compact heart-shaped mass the swarm may hang for a considerable time in several peaks. Care should be taken to see that every section is shaken into the box.

A simple method of dealing with after-swarms is to place an excluder between two empty hive-bodies, the lower of which rests on the ground or a bottom-board. The swarm should be shaken on to the excluder, when the bees go through the holes in the excluder, and the queens may easily be distinguished and removed. When the queens are gone the bees return to their parent hive, and the queens may be utilized for replacing old and failing queens. There need never be any doubt as to the advisability of taking every queen from an after-swarm; there inevitably is one queen left in the hive for the bees to return to.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Weed and Pest Control.

PREPARING the land for sowing and planting, and later harvesting the crops, keeps one busy most of the time, so that the recommendation to tidy up headlands and waste corners is inclined to be regarded as a counsel of perfection. However, it is beginning to be realized that this old-fashioned neatness has something more than sentiment to recommend it. Piling prunings and stumps into the base of the shelter-hedge; leaving boxes and implements on headlands and allowing weeds to grow through them make ideal conditions for the propagation of disease and pests. One has only to disturb such accumulations at any time to see the high esteem in which such conditions are held as desirable places of residence by insects and fungi of many kinds. Many of the weeds are hosts which carry over virus diseases and pests, which would otherwise die out, from

one season to another. For these reasons boxes, timber, and implements should now be stored in open sheds, and prunings and waste piled in an open space and burnt to produce wood ashes, which form a useful dressing when preparing land for cropping. It is advisable to collect also wire, stones, and anything which will prevent close mowing with a scythe towards the end of November before the weeds have commenced to seed. If this practice is continued, most annual weeds disappear and trouble from them will be greatly lessened. Very soon the growth becomes of such an innocuous character that it can, with advantage, be stacked and later dug into the soil, with cover crops, to provide humus. By planting crops suited to the conditions of land and climate and adopting clean farming methods losses from pests and disease may be reduced to a minimum. Any organisms of the kind that do appear should be studied, so that their name, habits, and appearance under all conditions are known. Then few of them will threaten serious loss, as those that are likely to do so will be anticipated and dealt with to best advantage. Where identification is difficult the specimens may be forwarded by post to the Director of the Horticulture Division, Department of Agriculture, Wellington, for a report.

Weeds and grass growing on drives and yards may now be destroyed by the application of a good chemical weed-killer. The drainage will then be more effective and a good surface maintained for a longer period.

Vegetable Crops.

Towards the end of November, when berry-fruits are in good supply on the markets, also green peas and summer vegetables, it is usually advisable to discontinue pulling rhubarb and cutting asparagus, so that natural growth may be encouraged and strong crowns built up for cropping another season when those supplies are lacking. It is generally advisable to assist this growth by applying a generous dressing of manures or fertilizers now, unless it was done during the winter or spring. Fowl manure is very suitable for this purpose. If farm manure is used it should be in a fermented state in which all weed-seeds are destroyed. An occasional dressing of lime will benefit both of these crops, especially where the land is heavy and sulphate of ammonia has been used.

The interest in sport and natural living has increased the demand for vegetables and fruit in both a solid and liquid form. Vegetable salads are being made with greater skill and are growing in popularity, while tomato juice as a beverage is recommended for everybody by leading dietists; it is certainly a very pleasant and refreshing drink. These trends are of the greatest interest to the producer, who should do the utmost to grow just what is required at the right season. There is room for a greatly increased consumption of these products, and any tendency in that direction should be supported and encouraged by the grower.

Planting the outside tomato crop is now being done. Good plants set low in well-prepared soil usually produce a fair crop. If the preparation of the land is incomplete it is unwise to rush the planting; and if plants are scarce the tendency to set out doubtful specimens should be resisted. Careful selection is necessary when pricking and planting out, when all blind and indifferent specimens should be discarded. It is better to grow a smaller area of good plants and plant spare ground with another crop.

The tomato crop in the unheated glasshouse now commences to ripen. When the surface of the ground is dry it is advisable to prune and train in the new growth and trim off and carry out and burn the lower leaves which have become exhausted. Where the land has an open subsoil and low water-level, a mulch of strawy stable manure, or just clean straw, is of assistance now in retaining moisture in the ground. Also a fortnightly application of liquid manure composed of fertilizers in solution applied after watering helps the plants to mature the crop.

The late crops, and half-hardy crops mentioned in these notes last month, may still be sown; also swede turnips in a cool open position.

Where land infested with bad weeds has to be cleaned it should receive a shallow ploughing when the weather settles, and weeds collected by means of the harrows should be burnt as soon as they are dry. In a fairly dry season work of this kind can generally be done very satisfactorily during the summer months. The land can then be planted rather close with a winter crop at the approach of the autumn rains; or rather heavily seeded for a green crop to plough under.

Small Fruits.

The harvest for fruits of this class commences with culinary gooseberries now, followed by strawberries, currants, raspberries, loganberries, Cape gooseberries, &c., filling in very satisfactorily the interval, which more or less takes place, between the seasons for the tree fruit. Distribution would no doubt be assisted if these facts were generally made known to the public. It is rather difficult for growers to realize that the majority of the consuming public know very little about fruit varieties and seasons. Next to putting the fruit on the market in good condition it is necessary to let the public know the particular kind that is "in," especially as regards that which is available for only a comparatively short period.

Another demand that is becoming more insistent is for fruit-juices for drinks. Many people, so authorities tell us, do not drink enough, and pure fruit-juices are being recommended. The juice of some kinds of small fruits makes very palatable liquors, and this appears to be another instance where growers might render timely assistance by offering the service in the right way.

Seasonable attention to crops includes light cultivation to destroy weeds, carefully avoiding injury to the fibrous roots which lie very near the surface. In many instances a dressing of nitrate of soda when the plants are in bloom or the fruit has set assists the crops. Currants, red and white, are greatly improved by attention to summer pruning; and strawberries should be mulched with straw as soon as the first truss has set, or, in its absence, rushes between the rows and pine-needles round the plants may be used.

The Homestead Garden.

Summer bedding plants, which are now being planted, if used with moderation and good judgment are an attractive feature in the garden, and are useful for brightening up beds and borders. For open, airy positions geraniums, pelagoniums, calendulas, stocks, and antirrhinums are among the most suitable, as they thrive well under such conditions and are rarely injured by high winds. In the driest positions petunias flourish where most other plants would fail. Towards the end of November, when these plants are cleared, seeds of biennials and perennials, such as wallflowers, Iceland poppies, and aquilegia, may be sown for planting out during the autumn.

Most kinds of climbing-plants look their best when carefully trained, and all of them should receive this attention when young. Chiefly it consists in tying in the young growth required to cover the allotted space, and stopping surplus growth by pinching out the growing-point after a few leaves have formed. In this way they become quickly established and completely cover the available space in a desirable manner. Young climbing-plants set out at the foot of a wall often suffer from lack of moisture during the summer; in dry weather they should be well watered, and a mulch of dry litter should be applied. When the roots have extended and reached moister ground they will generally be free from this danger.

Where spring flowering bulbs have to be lifted it should be done as soon as the foliage is ripe; in the case of daffodils especially it should be done promptly, as many kinds have a very short resting-period. They should be left on the ground for a few days in a shady place to cure and then cleaned and placed in shallow boxes, securely named and stored in a cool, well-ventilated shed until planting-time.

The long, dry period last summer was the cause of considerable anxiety where a garden was concerned, especially in warm localities. Extensive plantings of karo, *Pittosporum crassifolium*, stood it well, as did most other native plants; while many plants from South Africa thrived on it. The silver tree, *Leucadendron argenteum*, and the African lily, *Agapanthus umbellatus*, never looked better; and the rather common *Erica pyramidalis gracilis* has excelled itself during the following winter: never has it here been so fine as regards both vigour and bloom. Freezias are giving an abundance of blossom that exceeds all past records; and Watsonia, belladonna lilies, *Amaryllis belladonna*, Scarborough lily, *Amaryllis purpurea* (*Vallota purpurea*), and varieties of Sparaxis are in excellent condition. The experience indicates the suitability of plants of this class for localities where the summer is dry and warm and no water is available. For many plants these are evidently ideal conditions.

—*W. C. Hyde, Horticulturist, Wellington.*

In terms of section 2 of the Meat-export Control Act, 1921–22, Sir William Perry and Messrs. H. D. Acland and J. D. W. Ormond have been appointed producers' representatives on the New Zealand Meat-producers Board.

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ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

WHEAT-GRAIN FOR HORSES.

J. C. D., Methven :—

Is it dangerous to feed wheat to horses, provided it is fed with discretion? Some farmers have repeatedly used it with apparent success to strengthen oat-sheaf chaff. Is it advisable to crush it?

The Live-stock Division :—

Wheat as a stock-food for any animal must be used with discretion, and this applies more especially to the horse, in which case serious gastric trouble frequently occurs through too large quantities being given at a time. It should only be given well mixed with some bulky food such as chaff, and the small allowance of wheat should be added to the chaff at each feed—not mixed in bulk—thus avoiding the risk of any of the animals getting too much. The wheat should be rolled.

COUGH IN HOGGETS.

C. V. K., Fairlie :—

Hoggets are strong and not dying, but some of them have a cough. Turnips, hay, pine needles, and rock salt are being fed. Should they be dosed, and, if so, with what?

The Live-stock Division :—

The cough amongst the hoggets is caused by the lung-worm, which is usually, if not always, associated with the stomach-worm: the method of infection is practically the same for both parasites. Dosing for stomach-worms also destroys a certain number of the lung-worm larvæ, and if the former parasite is controlled and the animal's health maintained by the suitable feeding of crushed oats and chaff, the hoggets are able to throw off the remaining lung parasites. A solution of bluestone is recommended for treating sheep for parasites. This should be made up as follows: bluestone, 1½ oz.; water, 1 gallon. Dissolve the bluestone in 1 quart of boiling water and then add water to make up to 1 gallon. Enamel or earthenware utensils should be used. The dose is as follows: lambs, 1 oz.; hoggets, 1½ oz.; sheep, 3 oz. The drenching may be repeated at three-weekly intervals.

WASTE IN CONCRETE SILO.

A. B. C., Waitemata :—

A concrete silo, 10 ft. diameter by 12 ft. high (set in the side of a small hill), is made of tongued-and-grooved blocks 2 in. thick, with iron rods outside binding them together, and three openings or doorways on the side for emptying. There is too much waste round the outside and on top: it varies from about 8 in. to 12 in. The method of weighting is with concrete blocks.

The Fields Division :—

The waste referred to in the silo is very common in straight-sided concrete silos. The waste is greater when the material is in an over-mature condition when stacked. A certain amount of waste from shrinkage at the sides appears to be inevitable in all straight-sided silos, but the percentage of waste may be reduced very considerably by keeping the material up as high as possible in the centre during building, also by tramping the sides thoroughly. A crown of at least 4 ft. should be maintained in the centre. When the silo is full the weights should go on immediately. It would be well to first put a 4 in. layer of earth on top before placing the concrete blocks. If the material to be ensiled is saved in a green succulent condition the percentage of wastage will be much smaller.

THE PROSPECTIVE TREND IN THE PIG INDUSTRY.

THE increase in pig-meat production as an auxiliary to butterfat-production which was forecast last year has been fully realized, and a further substantial increase seems imminent provided the current widespread interest in improved pig husbandry is maintained and reflected in practice. The data available point to the conclusion that the Dominion's production of carcasses of porker weights now makes available for export a supply which approximates that which can be disposed of satisfactorily overseas, and, this being so, further expansion should be in the production of carcasses of baconer weights. Such a development probably would call for important adjustments in our pig-keeping, and about these adjustments that desirable type of knowledge which is based on thoroughly examined farm practice is not freely available. Hence there is urgent need for further investigation relative to several matters bearing on economic pig-production under the circumstances which seem likely to develop. This is being undertaken by the Divisions of this Department directly concerned. The following three problems are of outstanding importance: (1) The general production of pigs which provide the type of carcass suited to the needs of the prospective markets; (2) the association of good type of carcass with economical conversion of feeds into flesh—investigations already have established that there are strain variations in pigs in this respect analogous to the strain variations in dairy cows in their ability to utilize the feed provided; (3) the economical provision of feed to supplement dairy by-products when the supply of these is inadequate—this introduces crop-production and pasture-utilization problems which are being investigated by the Department. Work already done indicates clearly that a matter most acutely in need of improvement is the feeding, especially that of breeding-animals, during the period when dairy by-products are in scant supply. Until this, in conjunction with the general care of the stock, is made reasonably efficient, the considerable potential benefits from improvement of the class of pigs kept cannot be satisfactorily realized.—*Director-General of Agriculture, Annual Report.*

In rural industries, despite a prolonged adverse summer period in many districts, the volume of production has been well maintained at a point that indicates increased production capacity under normal seasonal conditions, which reflects most commendable efficiency of our farmers, when facing relatively difficult and sometimes even depressing conditions. Indeed, a close knowledge of the developments in our farming during the past five years or so suggests that the achievements in farming have reached a plane which farmers themselves a few years ago would have said could not be attained.—*Minister of Agriculture, Annual Report.*

The year was marked by the fact that record quantities of fertilizers were carried by rail. Most of the fertilizer is applied to grassland, and the increase in the quantities of fertilizers carried by rail is expected to prove valuable in maintaining the vigour and productivity of our pastures, which, certain evidence suggests, were beginning to react to the reduced top-dressing programmes of recent times.—*Minister of Agriculture, Annual Report.*

DEPARTMENT OF AGRICULTURE.

WALLACEVILLE POULTRY STATION.

FOR SALE—

WHITE LEGHORNS

10-weeks-old Pullets, and
Hens terminating First Laying Season.

For full particulars apply—
THE POULTRY OVERSEER,
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WEATHER RECORDS: SEPTEMBER, 1935.

Dominion Meteorological Office.

NOTES FOR SEPTEMBER.

AFTER a comparatively mild winter and indications of an early spring in the preceding month, the weather in September, at least during the first half, reverted to a cold and rather stormy type in most districts. Low temperatures on account of cold southerly or easterly winds prevailing, as well as extreme dryness in many parts, had the effect of retarding growth of vegetation. In the western and southern areas of the South Island conditions were particularly dry, and farmers have had to face a serious shortage of feed, with the result that there has been some loss of stock. There was also considerable mortality amongst lambs in the Gisborne, Hawke's Bay, and Marlborough Provinces owing to the cold, wet spells experienced. In most parts of the country, however, owing to a favourable winter, stock kept in good condition. In North Canterbury and Marlborough some heavy rains on the 9th relieved the situation, which had become serious owing to a prolonged period of dryness. South Canterbury did not benefit to the same extent, and good rains are badly needed in that district.

Rainfall.—Rainfall was very much above the average in the northern portion of the Auckland Peninsula, some places having more than double. The eastern districts of the North Island south of East Cape also had a considerable excess, but the remainder of the North Island received less than the normal falls. In the South Island Marlborough was the only district where more than the usual amount fell. In North Canterbury the totals closely approached the average, but all other districts experienced a very dry month.

Temperatures.—Temperatures were everywhere below the average. In the North Island the mean difference was 1·9° below; the South Island mean was 3·3° below.

Pressure Systems.—In the beginning of the month an anticyclone covered New Zealand, but the centre was situated in the south, while a cyclone was passing in the north. Consequently a cold south-easterly wind blew up the east coast, accompanied by rain and hail squalls in the area between Banks Peninsula and East Cape. Over the greater portion of the Dominion, however, fine weather prevailed, although temperatures were cold everywhere.

On the morning of the 7th another cyclone which had closely followed the track of the former was situated just west of the Auckland Peninsula, and rain developed in the Auckland Province, some heavy falls and thunderstorms occurring on the 8th. At the same time rain fell in far southern parts, but the weather was mild and pleasant over most of the Dominion. During the night of the 8th, however, the northern depression became more intense, and by the 9th rain became widespread, with many heavy falls, and southerly winds strengthened. The above-mentioned storm had passed away eastwards by the 11th, but strong southerly winds continued to blow up the east coast as far as East Cape, accompanied by frequent showers in coastal areas. Over the rest of the Dominion, however, and especially in western districts, although temperatures remained cold, the weather for the most part was fine on the 11th and 12th, and pleasant weather prevailed generally until the 15th.

On the morning of the 15th a cyclone brought rain to North Auckland. Consequently widespread rain fell in the North Island, many heavy downpours occurring, culminating in floods in North Auckland, and also in the Wairarapa on the 16th. On the 18th strong north-westerly winds blew, but rainfall was confined chiefly to the west coast districts.

From the 19th there followed a period of fine weather, but strong north-easterly winds and scattered rain occurred in the Auckland Province during the night of the 23rd and on the 24th.

Subsequently most parts of the Dominion experienced fine pleasant weather until the close of the month.

RAINFALL FOR SEPTEMBER, 1935, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	11·57	19	5·29	4·90	57·23	43·66
Russell	12·42	20	2·44	3·89	82·44	41·19
Whangarei	7·40	21	2·17	4·85	70·18	49·95
Auckland	2·76	10	1·76	4·05	50·59	38·52
Hamilton	2·21	10	0·58	4·32	36·69	37·43
Rotorua	3·24	10	0·81	4·97	54·85	41·83
Kawhia	1·41	7	0·44	4·57	..	40·75
New Plymouth ..	3·47	9	0·77	4·92	60·46	45·33
Riversdale, Inglewood ..	5·00	10	1·08	9·56	89·35	77·16
Whangamomona ..	0·74	2	0·59	7·11	62·97	56·10
Hawera	2·72	10	0·88	3·42	46·25	33·53
Tairua	4·15	17	1·79	4·92	61·79	50·63
Tauranga	5·36	18	1·90	4·29	51·08	40·41
Maraehako Station, Opotiki	4·47	11	1·85	4·21	57·71	41·94
Gisborne	5·32	20	1·44	2·99	38·67	37·28
Taupo	2·64	9	0·54	3·82	41·81	33·12
Napier	3·20	18	0·78	1·93	42·88	24·23
Hastings	4·63	18	1·13	2·63	34·54	26·05
Whakarara Station ..	3·72	10	0·82	..	52·23	..
Taihape	1·54	13	0·72	3·04	28·17	26·56
Masterton	7·06	16	2·74	3·00	35·72	29·54
Patea	2·96	12	0·97	3·59	43·82	33·03
Wanganui	1·73	7	0·65	2·87	32·10	26·72
Foxton	2·35	8	0·94	2·40	27·56	23·73
Wellington	4·80	13	2·02	3·20	29·69	32·87
South Island.						
Westport	2·79	11	1·07	8·30	66·77	70·80
Greymouth	1·75	7	0·95	8·09	71·81	73·06
Hokitika	1·71	7	0·71	9·02	82·72	82·31
Ross	2·67	6	1·59	12·43	86·89	94·81
Arthur's Pass ..	..	..	..	15·29	..	111·36
Okuru, South Westland	2·70	5	1·50	11·89	77·87	105·69
Collingwood	4·61	11	1·22	9·31	70·71	71·76
Nelson	0·76	7	0·29	3·58	34·49	28·44
Spring Creek, Blenheim	2·96	7	1·80	2·59	22·11	23·23
Seddon	3·55	7	2·34	2·14	16·38	18·76
Hanmer Springs ..	3·86	10	2·21	4·43	30·13	33·91
Highfield, Waiau ..	4·93	7	3·00	2·99	21·98	25·52
Gore Bay	3·52	5	1·74	2·94	18·56	24·25
Christchurch	1·83	9	0·95	1·93	15·77	18·92
Timaru	0·58	2	0·55	1·90	14·19	16·33
Lambrook Station, Fairlie	0·35	3	0·25	2·18	15·05	18·31
Benmore Station, Clearburn	0·21	4	0·11	1·93	15·69	17·95
Oamaru	0·63	8	0·25	1·64	14·93	16·08
Queenstown	1·37	4	0·82	2·54	23·49	21·97
Clyde	0·51	2	0·27	1·05	11·76	10·50
Dunedin	1·38	8	0·85	2·75	27·17	26·88
Wendon	0·54	3	0·45	2·42	25·13	21·69
Balclutha	1·10	4	0·83	1·89	24·40	18·16
Invercargill	1·12	9	0·30	3·24	37·16	33·02
Puysegur Point ..	4·14	11	1·33	6·36	65·00	61·71
Half-moon Bay ..	1·55	10	0·64	5·02	43·33	42·94